FIELD CROP ABSTRACTS

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REVIEW ARTICLE

THE EFFECT OF UNDERSOWING ON THE CEREAL COVER CROP

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INTRODUCTION

The farm has to be considered as a unit when the method of pasture establishment is being decided and, as a result, the decision to sow the herbage seeds under a cover crop is one which is frequently made. Some methods for the establishment of forage crops are better than others, but the cropping rotation, labour supply, the power unit and implements available are factors to be taken into consideration. If the total area of land available is small, the avoidance of an apparently unproductive period between the harvesting of a crop and resowing the land to grass is attractive. One factor that must be given careful consideration is that the cereal nurse crop in the seeding year can carry the cost of establishing a ley. In a trial recently concluded, it was found that the cost per cwt. of starch equivalent produced in the seeding year was over £3, which is in marked contrast with a figure of about 10s. in each of the subsequent three years.*

If a cover crop is not used, it may happen that an unremunerative crop of weeds takes its place and on land which is sloping, or for other reasons is subject to erosion, losses will be less if a quick-growing cereal cover crop is used in addition to the slower-growing small-seeded grasses and clovers.

There is considerable evidence of poor establishment and low yields of herbage following the undersowing of grass and clover seeds with cereals (5), (6), (39). Undersowing with one-year ley mixtures is a frequent practice in arable rotations in the United Kingdom, but doubts have been expressed in the case of sowing longer-term leys (25). In a survey of 417 cases of reseeding in Yorkshire, Moore found competition from the nurse crop caused 46% of the failures, whereas 27% was caused by lodged corn.

Undersowing a cereal crop may result in a reduced yield of the cereal and cause a modification of husbandry practice. For instance, applications of nitrogen may have to be reduced to decrease the danger of lodging, and seed rates of the cereal may be reduced for the same reason. Both factors, especially the nitrogen, could lower cereal yields.

INTRINSIC EFFECT OF THE UNDERSOWN LEY UPON THE CEREAL CROP

In the interaction of nurse crop and undersown herbage, competition for water, plant nutrients and space has to be considered. If the growth of the undersown species is rapid they might also compete with the cereal for light. Another possibility is that a legume sown under a cereal might supply the latter with symbiotically-fixed nitrogen. The effect of undersowing is the product of a complex of factors and may be considered in terms of competition from grass or legume, or a mixture of both.

THE EFFECT OF UNDERSOWING WITH LEGUMES

FIELD TRIALS

The few available records of the effect of undersowing with a legume on cereal yields indicate that straw is affected more than grain. In a series of trials carried out in Denmark from 1910–16 on a light sandy soil, the mean grain yield was not affected by undersowing with serradella (*Ornithopus sativus*) or red clover (40). The straw yield, however, was 63% higher when serradella was undersown and 26% higher when red clover was used, compared with oats sown alone. The variation in the effect of undersowing from year to year ranged from a marked increase in the yield of both grain and straw, to a marked decrease in both, compared with the yields when no undersowing was carried out. In Denmark, Neilsen (27) found that the grain yield average for 8 years was the same from oats sown alone, undersown with serradella, crimson clover or red clover. The straw yield was 24% higher when undersowing with serradella was carried out, 17% higher with crimson clover and 5% with red clover. Thus straw yield, again, was affected more than yield of grain.

When a forage crop is sown under oats, conditions are usually made as favourable as possible for the latter. One of the measures adopted by some farmers is to delay the time of sowing of the herbage seeds and, under these conditions, even rapid-growing forage plants, such as red clover

*I am indebted to Mr. R. Holliday, Department of Agriculture, The University, Leeds, for this information.

and Italian ryegrass, can have but slight effect on the cereal cover crop. At Rothamsted (33) barley was used for a cover crop, and red clover and Italian ryegrass, alone and in combination, were undersown and two levels of nitrogenous manuring used. The herbage seeds were not sown until a month after the cereal had been drilled and, in these conditions, the barley did not show any reduction in yield due to competition from the clover, except in one set of plots. There was no benefit to the barley from the legume in this trial. At Aberystwyth, Charles (4) also found that undersowing with red clover did not affect oat yields or its response to nitrogen.

In using data from crop rotation experiments, care has to be taken that treatments earlier in the rotation and other factors are similar. This is especially so in considering the effects of undersowing on cereal yields as these effects, in themselves, may be small. Information of this nature cited by Garner (14) from Rothamsted and Woburn show that at the former centre, undersowing with red clover in two seasons had practically no effect on barley yield. There was some evidence that clover had a slightly beneficial effect. Undersowing barley at Woburn with clover in 1937 and with trefoil in 1955 had no effect on cereal yield, but in 1956 the yields were 13% higher when undersown compared with the cereal grown alone. In Illinois, Pendleton (29) found that intersowing red clover with oats did not seriously reduce grain yields, but did result in a lower yield in each of three years and this effect was increased in a dry season and by increasing the row width of the cover crop.

BENEFIT TO THE CEREAL DUE TO THE RELEASE OF NITROGEN BY THE LEGUME

Results of field experiments show that sowing a legume under a cereal sometimes increases cereal yields. This may be due to release of nitrogen by the legume, though the evidence reviewed by Wyss and Wilson (47) shows that this is by no means universal. In view of this it is not surprising that conflicting results are obtained under field conditions. In considering the benefit that the cereal may derive from association with a legume, two important factors are involved : (a) the time at which the cereal is capable of taking up nitrogen and (b) the time at which the companion legume releases it.

Data cited by Halliday (16) indicate that a legume sown under a cereal cover crop would have to develop quickly and release nitrogen in the first three months after sowing, if the cereal cover crop is to benefit. In oats, Halliday found that nitrogen uptake after mid-June is almost negligible ; in barley the greatest absorption of nitrogen occurred between mid-May and the beginning of July ; winter wheat, however, absorbed 25% of its nitrogen in July, although the maximum uptake occurred between mid-May and mid-June.

Thornton and Nicol (42) found that lucerne grown with Italian ryegrass could supply the latter with nitrogen within three months of sowing. This was under pot conditions. Cereals, however, develop at a faster rate than Italian ryegrass and they suppress a companion legume to a greater extent than even this rapid-growing forage grass.

Further evidence on the time which elapses between the sowing of a legume and the release of nitrogen was obtained by Nowotnowna (28) with plants grown in a rooting medium of sand with no added nitrogen. It was found that in a period of 13 weeks from sowing, the total yield of dry matter of ryegrass, grown in the presence of inoculated peas, red clover or serradella, increased by about three times in the pea/ryegrass series, twice in the clover/ryegrass series and nearly twice in the serradella series, compared with ryegrass grown alone. The nitrogen percentage and total nitrogen yield of ryegrass also were greatly increased when grown in association with a legume.

In another experiment Nowotnowna found that when barley was grown with peas, red clover or lucerne, only peas increased the yield of dry matter, nitrogen percentage, and total nitrogen of the cereal. Nowotnowna points out that by the time the red clover and lucerne were in the flowering stage, the accompanying barley had already ripened. He postulates that the flowering period of leguminous plants is also the time of most vigorous fixation of nitrogen by the nodule bacteria. Thus the liberation of nitrogenous compounds from the lucerne and clover began at a stage of growth of the barley much too late for it to benefit from the process. The beneficial effect of peas was stated to be due to the coincidence of flowering in peas with the time at which it was possible for the cereal to take up the nitrogen released by the legume. Perennial ryegrass, because of its longer life, was able to take up nitrogen during the whole of the time from sowing to ripening of the barley. It was concluded from this that for a short-lived grass to derive benefit from association with a legume having a longer growth season, it is necessary to sow the legume first in order to compensate for the difference in time of flowering. This evidence indicates that undersowing with a perennial herbage legume is not likely to benefit its cereal cover crop.

In the course of investigating the possible benefit to oats of growing them with a legume (peas), Gliemeroth (15) found that during the early stages of development, oats grown alone absorbed greater quantities of nitrogen than those grown in a mixture ; later, greater amounts of nitrogen were absorbed by the mixture. The time at which this occurred varied from year to year and studies of

the legume root-nodules revealed marked differences in the time nodule degeneration began. Early nodule degeneration was found to correspond with an early increase in nitrogen uptake by the mixture. It was postulated that these differences in time of nodule degeneration determine the variations in nitrogen uptake by cereals growing with the legume.

The evidence from field trials shows that the association of a cereal with a legume cannot be relied upon to increase the percentage protein and far less to increase the total protein of the cereal. Data cited by Westgate and Oakley (43) from an analysis of wheat and crimson clover grown singly and in mixtures of varying proportions of each, showed that both the wheat and the clover had a higher percentage protein when grown alone.

It may be misleading to consider only the percentage nitrogen in the cereal and legume as evidence of the occurrence of release of nitrogen by the latter ; the nitrogen percentage of the cereal may be higher when grown with a legume than without, but its yield may be reduced by competition and therefore the total yield of nitrogen in the cereal may be less than if it was grown alone. In oat/vetch mixtures at Rothamsted (32), (33), (34), (35), the percentage nitrogen in oats was higher in the mixture with a legume, but the total quantity of nitrogen produced was less. There was thus no evidence that any nitrogen released by the vetches proved beneficial to the oats. In Sweden, Bacher (1) found that the percentage of crude protein in peas was consistently lower when grown with a cereal than when grown alone, but the percentage in oats increased as that in peas increased. Despite this, however, the yield of nitrogen produced by the oats was, again, not materially affected by being grown in association with the legume. Undersowing barley with red clover was reported by Russell (36) to have no effect on the yield or percentage nitrogen in the cereal grain.

POT EXPERIMENTS

Evidence presented by Mann and Barnes (22) derived from an investigation conducted with barley in pots showed that red clover reduced the total nitrogen in the barley crop above ground by 10–18% with different plant densities of clover.

In this investigation, the effects of varying densities of clover and barley were also considered and it was found that cereal yield was reduced at each of four densities of barley by undersowing with red clover. In general, increasing the density of barley reduced the depressing effect of clover. The number of tillers in the cereal, however, was higher in the presence of clover at the highest plant densities, but not at the lower densities.

Drake and Steckel (8) grew oats and red clover together under conditions in which nitrogen was not a limiting factor and found that oats grown with clover contained 32% more dry matter and 62% more phosphorus than when grown alone. In this investigation, however, the clover had been grown for thirty days and had five or six leaves before the oats were sown. They concluded that oats were able to benefit from association with clover because phosphorus availability was increased by the latter.

THE EFFECT OF UNDERSOWING ON MAIZE YIELDS

Undersowing of maize is considered separately from other cereals, as it is grown in rows wide enough apart to allow inter-row cultivation to be a common practice. Herbage crops grown between maize plants can provide a winter cover and prevent erosion, as well as being a potential forage crop.

Nitrogen and water have been shown by Kurtz *et al.* (20) to be important factors in the competition between maize and intercrops of legumes and grasses. In their investigation, adequate quantities of water and all nutrients, except nitrogen, were supplied and it was found that the yields of maize were greatly reduced by the plants growing between the rows. The addition of nitrogen (approximately 250 lb. per acre) brought the yield of maize to within 15% of that of maize grown alone. Little difference between the effect of grasses and legumes occurred in this trial ; four grasses and ten legumes were studied and in the absence of applied nitrogen, legumes reduced the yield of maize as much as the grasses did. Further, the response to nitrogen was as great in the case of the cereal grown with legumes as it was when it was grown with the grasses.

In another investigation, Stivers (41) also found that intercropping maize with ladino clover produced nitrogen-deficiency symptoms in the leaves. Maize ear-size was reduced, but here again the condition was corrected by adding nitrogen. In earlier experiments, Mooers (24) established good stands of cowpeas and soyabeans with maize, and McClelland (23) used velvet beans and mung beans in addition to the species used by Mooers ; both investigators found that these legumes reduced cereal yield.

The earlier the forage- or cover-crop is sown before the maize, the better its yield, but the greater is the competition with the cereal and this results in lowered grain yield. It is reported by Jackobs and Gossett (17) that in lucerne, the earlier sowing and consequent better growth depressed maize yields more than later sowings. Weed growth, however, was greater in the earlier sowings.

The optimum date for sowing herbage seeds in maize depends on the relative importance of the cereal and the undersown crop in the farm economy, as well as on the temperature, the

amount and distribution of rainfall, and the distance between the maize rows. Schaller and Larson (37) suggest that for conditions in Iowa, 20 June is a date at which to aim. The importance of rainfall in assessing the competition between maize and intersown lucerne is discussed by Pendleton *et al.* (30). These authors concluded that in dry years or in areas of low rainfall the reduction in the yield of cereal would be serious. In their investigation, even when a 10-in. band on each side of the maize rows was clean-cultivated and the lucerne sown between the rows clipped periodically, maize yields were reduced by 10–27% compared with clean-cultivated plots.

EFFECT OF UNDERSOWING WITH GRASS

The relative speed of development of grass and an associated cereal was investigated by Mann and Barnes (21). This work was carried out in pots and it was found that the effect of *Holcus mollis* on barley was to reduce its yield and in some cases to eliminate the barley altogether. If the grass commenced growth before the barley, then it was possible for it to suppress entirely the growth of the cereal. In the event of both starting to grow at the same time, the yield of barley was reduced by one-third or more. If, however, the cereal grew away before the grass, then it was able to suppress it and sustain no loss in yield, provided that the stand was thick enough.

The rate at which barley was sown also modified the outcome of competition between *Holcus* and barley. Even when the grass grew away before the cereal, a 50% yield was obtained if the barley was sown at a high seed rate, but at a low seed rate the cereal was eliminated. The density of the grass was found to affect the cereal yield. At a light sowing of barley, provided it was satisfactorily established, the number of units of grass made no difference to the cereal yield. If, however, the *Holcus* and barley grew away together, competition was on equal terms ; any differential increase in the growth of *Holcus* resulted in an almost equal reduction in the growth of the cereal.

Data cited by Mann and Barnes (21) indicate that there was some factor involved in the interaction of the grass and barley which could not be explained by competition for water, light or nutrients. In pots, the optimum root space and nutrient supply were determined and it was found that even when sufficient for both, the barley and *Holcus* reduced the growth of each other. These investigators conclude that the effect of barley on *Holcus*, in this respect, was somewhat more pronounced than that of *Holcus* on barley. This experiment also revealed that competition for nitrogen depended on the relative speed of establishment and the seed rate of the cereal. The higher the cereal seed rate, or its speed of establishment in relation to that of *Holcus*, the more efficiently did it compete for nitrogen. At Aberystwyth, Charles (4) found that undersowing Italian ryegrass in an oat crop reduced the response of the latter to nitrogen, the increase in straw yield due to the application of nitrogen being 30% when not undersown and 6% when undersown, whereas the corresponding increases in grain were 12% and 3%, respectively.

Evidence from field trials shows that undersowing with Italian ryegrass can result in a serious reduction in cereal yield. Evans (9) found that the undersowing of barley, sown at a medium rate of 120 lb. per acre, with a mixture containing a high proportion of Italian ryegrass reduced the yield of barley by over 50%. Two mixtures were used, both containing the same quantity of smooth-stalked meadow grass (*Poa pratensis*) and wild white clover, but to one was added 34 lb. of Italian ryegrass per acre. The barley on the latter plots ripened about a week before the plots undersown without Italian ryegrass and grain yields were markedly lower. The effect of Italian ryegrass was greatest on the replicates where the yields of cereal were lowest.

In Evans' view, competition for water was a main cause of this reduction in grain yield. The soil in which the trial was conducted was of light texture and the rainfall in the month before harvest was well below average. Evans points out that Italian ryegrass is also highly competitive for nutrients with other grasses and clover. He also found that Italian ryegrass sown under S172 winter oats in autumn, grew taller than the oats by the time the latter were ripe. Again, the yield of cereal was much reduced by Italian ryegrass (10).

Work carried out at Woburn (14) bears out Evans' findings, in that ryegrass reduced the yield of barley ; differences were, however, much less marked than at Aberystwyth.

Data from the Netherlands cited by Evers and Sonneveld (12) show that undersowing under their conditions is unlikely to reduce the grain yield of cereals. Thus, in trials in which ten grasses and nine cover crops were used, oats, spring- and winter-wheat and spring barley were not affected by undersowing. Cereals, however, were less susceptible than beans to competition from grass ; Italian and perennial ryegrasses, cocksfoot and red fescue (*Festuca rubra*) all reduced the yield of beans when this was the cover crop. Evers (13) states that Italian ryegrass was the only grass which developed quickly enough under a cereal to make a reduction in yield of the latter a possibility. Field trials on undersowing with legumes indicate that the straw yield of the associated cereal was increased more than that of the grain. In a trial on grass-seed production in which the grasses were established under a cereal cover crop (11), the method of sowing the grasses also affected straw yield, but not grain yield. The grasses used were

red fescue, meadow fescue (*Festuca pratensis*) and cocksfoot, sown in 8 different combinations of spacings of oats and grass. In one method where the grass was drilled in the centre of the space between the oats rows, the straw yield was significantly higher than in the method where the grass was drilled close to the oats.

Work carried out in Kenya indicates that slow-developing grasses such as Nandi *Setaria* and molasses grass (*Melinis minutiflora*) had little effect on the yield of a cereal cover crop. In a personal communication, Dennison (7) reports no reduction in yield from undersowing wheat with Nandi *Setaria* at 20 lb. per acre, though the wheat yields were very low. Evidence presented by Boswinkle (3) from a trial with wheat in 7- and 14-inch row-spacings in the Rift Valley Province shows that undersowing wheat with Nzoia Rhodes grass (*Chloris gayana*) caused a significant reduction in yield of grain, compared with wheat sown alone. Wheat undersown with molasses grass also suffered a decrease in yield, but this was not significant. Nandi *Setaria* was found to have a poor establishment under wheat in low rainfall conditions and no effect on wheat yield was recorded. Jones (19) in the Kenya Highlands found that undersowing mixtures of 5 lb. Italian ryegrass and 10 lb. Danish cocksfoot per acre did not reduce cereal yield. Under these conditions the rapidly developing Nzoia Rhodes grass reduced cereal yield.

In Ohio, undersowing has been reported to reduce the yield of cereal cover crops under unusual circumstances only, but Willard (45) reports one instance where timothy sown thickly in the autumn with winter wheat did reduce the yield of the cereal. This, however, is not general agricultural practice.

THE EFFECT OF UNDERSOWING WITH MIXTURES

In farm practice, the cereal is usually undersown with mixtures of herbage legumes and grasses and any influence on the cover crop must be attributed to their combined effect.

Garner (14) states that at Rothamsted in 1931 and 1936 and in another series of trials in 1951–3 in which four separate comparisons could be made, undersowing barley with a mixture of ryegrass and clover had a negligible effect on the yield of cereal. Similar results were obtained from Woburn during 1939–41 when the average of three years' data on wheat yield was considered. In one year, however, the yield of wheat not undersown was 14% higher than when undersown.

The time of sowing the herbage crops under a cereal has a marked effect on competition between cover crop and potential forage crop. In a trial conducted on a heavy Old Red Sandstone soil in 1955 (26) wheat was undersown with a mixture of perennial ryegrass, cocksfoot, timothy and red and white clovers. In this instance, the cereal had made appreciable growth before the herbage mixture was sown and the wheat yield was not affected. At this centre in 1956 a more comprehensive trial was laid down and further evidence on the importance of time of undersowing was obtained. The same herbage seeds mixture was used as in the previous year but sowing was done (a) at the same time as the wheat and barley cover crops and (b) when the cover crops were well established. Both cereals showed reduced yields when undersown at the time of drilling, but not when they were allowed to grow away before the herbage crops were sown. In this trial the influence of seed rate of the cover crop was also investigated and it was found that the reduction in yield of wheat caused by undersowing was small at the lowest seed rate, but became larger with increasing density of cover crop. The influence of seed rate was appreciable in the case of barley, and the greatest reduction in grain yield occurred at the highest seed rate ; the effect on yield of the medium seed rate was, however, smaller than where the lowest rate was used.

A further aspect of competition between cover crop and undersown herbage was considered in this trial, namely, the influence of nitrogen applied as 2 cwt. per acre of nitro-chalk in the seed-bed or as a late top dressing. The reduction in yield of cereal cover crops was greater in the absence of nitrogen, or when it was applied in the seed-bed rather than as a later application. In contrast to wheat, when barley was used, late application of nitrogen did not reduce the effect of undersowing. The crude-protein percentage of both cereals was not influenced by undersowing. These results from one year only, indicate that undersowing can reduce the yield of a cereal cover crop and also that time of undersowing, seed rate and nitrogen application, all have a bearing on reduction in yield.

Where soil potassium is low, Blaser (2) found indications that undersowing oats with a mixture of cocksfoot and lucerne would not result in a lowering of the yield of the oats. This was based on a study of competition for potassium between oats and the undersown grass/legume mixture. The cereal proved much higher in potassium content than the forage crop and is therefore unlikely to suffer through competition for this nutrient.

HARVESTING DIFFICULTY CAUSED BY UNDERSOWING

One of the dangers of undersowing is that harvesting difficulties are increased, particularly in wet districts ; Roberts (31) comments on this danger in wet upland areas, but in his experience, late sowing of the herbage mixture in an attempt to reduce the difficulty of harvesting is not to be recommended, as the risk of a poor establishment of the ley is too high. Jones (18) makes similar

comments, based on experience of the drier areas of Britain. Despite this, there is evidence (25) to show that in the United Kingdom, sowing the ley after the cereal is practised extensively in the arable regions of the country.

There is little experimental evidence on the effect of various grasses and legumes on harvesting cereals. Williams (46) at Aberystwyth observed the effect of undersowing four grasses and nine legumes on the drying of oat sheaves. Sheaves containing red clover were found especially difficult to dry. Under Ohio conditions, according to a personal communication from Willard (45), sweet clover frequently grows tall enough to interfere with combining. This is especially true when oats are used as a cover crop, but it also occurs when wheat is undersown. This difficulty is referred to by Willard *et al.* (44) and delayed sowing of the forage crop is advocated to reduce difficulty in harvesting the cereal. Scholl (38) reports that in Iowa, too, sweet clover can interfere with grain harvest when sown under a nurse crop ; this is also occasionally true of lucerne when conditions are very favourable for its growth. Investigation of the effect of Italian ryegrass, red clover and a mixture of both on the drying of oat sheaves (4) revealed that Italian ryegrass interfered little with drying, but where red clover had been sown the harvested sheaves contained appreciably more moisture than where oats, alone, had been sown. Sheaves harvested where a mixture of red clover and Italian ryegrass had been undersown showed increasing moisture content as the proportion of red clover in the herbage increased.

CONCLUSIONS

The amount of experimental evidence relating to the effect of undersowing on a cereal cover crop, in general, is small and has been obtained largely in the course of investigation of other problems. The data available indicate that the effect of legumes, on the whole, is slight and the influence on grain yield is less than that on straw. To benefit a cereal growing in association with it, the legume would have to develop quickly and liberate nitrogen in a relatively short time. Information obtained under pot conditions indicates that red clover can benefit oats growing with it by making phosphorus available to the cereal. It should be borne in mind that, although the influence of a legume on a cereal cover crop is small, any increase in total production resulting from the undersowing of a legume must be a point in favour of the practice.

Undersowing maize reduced its yield and no difference between the effect of legumes or grasses has been detected. Competition between undersown herbage and maize for nitrogen and water has been shown to be an important factor. The damaging effect of undersowing increased with early sowing of the forage seeds ; the most satisfactory date for carrying out this operation is dependent on the relative economic importance of the cereal and herbage crops in the farm practice, as well as on rainfall and climate.

It has been shown that under pot conditions and in the field, undersowing with grass can reduce the yield of the cereal cover crop ; a rapid-growing grass sown at the same time as the cereal can cause a serious reduction in yield. Italian ryegrass has been found to be especially harmful in this respect. The higher the cereal seed rate, or the quicker its speed of establishment, the less the adverse influence of the undersown herbage.

Undersowing with a grass/clover mixture may reduce cereal yield or may have no effect on it, but there is no recorded instance of a mixture increasing the yield of a cover crop. A delay in sowing the herbage seeds mixture reduces this harmful effect, but conditions are thereby made more difficult for the establishment of the forage crop. The seed rate of the cereal, the application, and the time of application, of nitrogen have been shown to have a bearing on the outcome of the competition between undersown herbage and cereals. The limited evidence available from pot experiments indicates that in soils of low potash content the competition for this element may favour the cereal rather than the undersown herbage.

Harvesting operations are sometimes difficult because undersown herbage has made considerable growth. This difficulty is aggravated in areas of high rainfall and late harvest. It has been observed that red clover, sweet clover and occasionally lucerne are the species most likely to interfere with cereal harvesting when undersown to a cereal cover crop.

BIBLIOGRAPHY

(1) Bacher, I. 1949. Blandsäd av havre och ärt. [Mixtures of oats and peas.] *Medd. 28 Lantbr-Högsk. JordbrFörsöksAnst.* pp. 80.

(2) Blaser, R. E. 1957. Personal communication.

(3) Boswinkle, E. 1954. Unpublished.

(4) Charles, A. H. 1957. Unpublished.

(5) Davies, W. 1927. Seeds mixtures problems : Soil germination, seedling and plant establishment with particular reference to the effects of environmental and agronomic factors. II. Field trials. *Bull. Welsh Pl. Breed. Sta.* Ser. H. No. 6, 39-63.

(6) ———— 1928. The factor of competition between one species and another in seeds mixtures. *Bull. Welsh Pl. Breed. Sta.* Ser. H. No. 8, 82-144.

(7) Dennison, P. G. 1957. Personal communication.

(8) Drake, M. and Steckel, J. E. 1955. Solubilization of soil and rock phosphate as related to root

cation exchange capacity. *Proc. Soil Sci. Soc. Amer.* **19,** 449-50.

(9) Evans, Gwilym. 1933. The influence of Italian ryegrass on barley. *Welsh J. Agric.* **9,** 142-5.

(10) Evans, G. 1937. Unpublished.

(11) Evers, A. and Sonneveld, A. 1953. Graszaadteeltproeven. De invloed van verschillende zaaisystem met dekvrucht (haver) op de opbrengst van de dekvrucht en de ontwikkeling van de ondervrucht. [Grass-seed production trials. The effect of different systems of undersowing in nurse crops (oats) on the yield of the nurse crop and the development of the undersown crop.] *Gestencilde Meded. No. 12 Cent. Inst. Landbouwk. Onderz., Wageningen,* 27-34.

(12) ————, ———— 1954. Graszaadteeltproeven, II. [Grass seed production trials, 2.] *Gestencilde Meded. No. 9 Cent. Inst. Landbouwk. Onderz., Wageningen,* pp. 47.

(13) ———— 1956. Personal communication.

(14) Garner, H. V. 1956. Personal communication.

(15) Gliemeroth, G. 1951. Untersuchungen zur Frage der Stickstoffabgabe von Leguminosen an begleitenden Stickstoffzehrer. [Investigations on the problem of nitrogen applications for legumes and associated nitrogen-consuming plants.] *Z. Acker- u. PflBau* **94,** 106-32.

(16) Halliday, D. J. 1948. A guide to the uptake of plant nutrients by farm crops. *Bull. 7 Jealott's Hill* pp. 34.

(17) Jackobs, J. A. and Gossett, D. M. 1956. Seeding alfalfa over corn with a cultipacker-type seeder. *Agron. J.* **48,** 194-5.

(18) Jones, D. J. C. 1957. Early stages in ley establishment. *Agriculture, Lond.* **63,** 509-13.

(19) Jones, R. 1957. Personal communication.

(20) Kurtz, T., Melsted, S. W. and Bray, R. H. 1952. Importance of nitrogen and water in reducing competition between inter-crops and corn. *Agron. J.* **44,** 13-17.

(21) Mann, H. H. and Barnes, T. W. 1947. The competition between barley and certain weeds under controlled conditions. 2. Competition with *Holcus mollis. Ann. appl. Biol.* **34,** 252-66.

(22) ————, ———— 1952. The competition between barley and certain weeds under controlled conditions. 5. Competition with clover considered as a weed. *Ann. appl. Biol.* **39,** 111-19.

(23) McClelland, C. K. 1928. The effect of interplanted legumes on the yields of corn. *Bull. 229 Arkansas Agric. Exp. Sta.* pp. 19.

(24) Mooers, C. A. 1927. Effects of planting soybeans and cowpeas with corn. *Bull. 137 Tennessee Agric. Exp. Sta.* pp. 18.

(25) Moore, H. I. 1945. The nurse crop in ley establishment. *J. Minist. Agric.* **52,** 245-8.

(26) NAAS Experimental Husbandry Farm, Rosemaund. 1957. Unpublished.

(27) Neilsen, N. J. 1929. Udbytte- og Eftervirkningsforsøg med forskellige Bælgplanter 1914-1924. [Trials on the yield and residual effect of legumes 1914-1924.] *Tidsskr. Planteavl* **35,** 269-92.

(28) Nowotnowna, A. 1937. An investigation of nitrogen uptake in mixed crops not receiving nitrogenous manure. *J. agric. Sci.* **27,** 503-10.

(29) Pendleton, J. W. 1957. The effect of clover row spacing and rate of planting on spring oat yields. *Agron. J.* **49,** 555-8.

(30) ————, Jackobs, J. A., Sliffe, F. W. and Bateman, H. P. 1957. Establishing legumes in corn. *Agron. J.* **49,** 44-7.

(31) Roberts, R. A. 1931. The making of pasture. 2. North Wales. *J. roy. agric. Soc.* **96,** 74-84.

(32) Rothamsted Experimental Station. 1930. *Rep. Rothamsted Exp. Sta.* 142-4.

(33) ———— 1931. *Rep. Rothamsted Exp. Sta.* 142 ; 150-3.

(34) ———— 1932. *Rep. Rothamsted Exp. Sta.* 148-9; 152.

(35) ———— 1933. *Rep. Rothamsted Exp. Sta.* 131-2.

(36) Russell, E. J. 1935. Soils and fertilizers. *J. roy. agric. Soc.* **96,** 357-61.

(37) Schaller, F. W. and Larson, W. E. 1955. Effect of wide spaced corn rows on corn yields and forage establishment. *Agron. J.* **47,** 271-6.

(38) Scholl, J. M. 1957. Personal communication.

(39) Stapledon, R. G. and Jones, R. 1925. Seeds mixtures for temporary grass. Investigations conducted in Denmark and Sweden and observations on trials of a similar nature in progress at Aberystwyth. *Welsh J. Agric.* **1,** 60-98.

(40) Statens Planteavlsudvalg. Denmark. 1917. Forsøg med Dyrkning i Havre af Serradela og Tidlig Rødkløver til Grøngødning. 1910-16. [Trials on growing *Serradella* and early red clover for green manure, with oats as a nurse crop.] *Tidsskr. Planteavl* **24,** 614-8.

(41) Stivers, R. K. 1956. Influence of interplanting of corn and ladino clover on the yields of corn. *Agron. J.* **48,** 97-8.

(42) Thornton, H. G. and Nicol, H. 1934. The effect of sodium nitrate on the growth and nitrogen content of a lucerne and grass mixture. *J. agric. Sci.* **24,** 540-3.

(43) Westgate, J. M. and Oakley, R. A. 1914. Percentage of protein in non-legumes and legumes when grown alone and in association in field mixtures. *J. Amer. Soc. Agron.* **6,** 210-5.

(44) Willard, C. J., Jones, E. and Haynes, J. L. 1954. Choosing and sowing meadow and pasture seedings. *Bull. 261 Ohio State Univ.* pp. 31.

(45) ———— 1957. Personal communication.

(46) Williams, R. D. 1922. Winter keep. *Welsh J. Agric.* **1,** 119-30.

(47) Wyss, O. and Wilson, P. W. 1914. Factors influencing excretion of nitrogen by legumes. *Soil Sci.* **52,** 15-23.

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FIELD CROPS

CEREALS

WHEAT

See also Abs. 1418, 1419, 1437, 1710, 1725, 1726, 1727, 1734, 1790, 1798, 1843, 1844, 1849, 1852, 1855

1364 Sivori, E. M. Epoca de siembra y período vegetativo del trigo. Interpretación según la teoría del desarrollo. [**Sowing time and vegetative period of wheat. Interpretation according to the theory of development.**] *Rev. argent. Agron.* 1957, **24**, No. 4, 144–56, bibl. 19, illus.

In the Plata region of Argentina wheat is sown from early May to mid August (3·5 months). The object of this study was to analyse, in the light of the theory of phasic development, the results from trials carried out by various authors in South America to determine suitable sowing dates for each wheat variety, and the adaptation of these varieties to delayed sowings without their yields being affected.—E.B.O.

1365 Pool, M. and others. **Effect of delayed harvest on quality of soft red winter wheat.** *Agron. J.* 1958, **50**, No. 5, 271–5, bibl. 16. [Purdue Univ. Agric. Exp. Sta., Soft Wheat Quality Lab., Ohio Agric. Exp. Sta. and the Crops Res. Div. U.S.D.A.]

1366 Pisarenko, G. S. [**Peculiarities of seed production in winter wheat grown at different altitudes in the Kabardino-Balkar ASSR.**] [Russian] *Selek. Semenovod.* (*Selection and Seed Prod.*) 1958, **23**, No. 1, 32–6.

The region comprises 3 natural zones, namely, (1) mountain (wet) ; (2) foot-hill (variable precipitation) ; and (3) steppe (dry). During 1950–52 observations were made at 200, 524, and 1200 [m.a.s.l.] on the Novoukrainka 83 var. of winter wheat, sown in autumn, 1949, at each of the 3 altitudes. The data show that, in regard to greater plant weight, increased weight of 1000 grains, less spoilt grain and improved germination capacity, steppe conditions are preferable. This was confirmed with tests made in 1955/7 which included, in addition, the winter wheat Osetinskaja 3 (4-fold replication). Variations in protein content of the grain, as affected by growing a crop in an environment different from that where it was originally produced, are recorded.—M.H.

1367 Carson, G. P. **Descriptions of wheat and oat varieties.** *J. nat. Inst. agric. Bot.* 1957, **8**, No. 1, 27–35, bibl. 4.

Cereal varieties recently provisionally recommended by the N.I.A.B. are described botanically, and reference is made to additional diagnostic characters, namely glume texture and surface in wheats and grooves in the rachilla of oats. Varieties described are Dominator winter wheat, Fylgia II and Koga II spring wheats and Powys winter oats. F.S.—A.M.H.

1368 Rivett, A. D. **Winter wheat variety trials : 1952-1956 (Juliana control).** *J. nat. Inst. agric. Bot.* 1957, **8**, No. 1, 19–26, bibl. 4.

The results of 28 trials with the following late-maturing varieties of winter wheat : Banco, New Wilma, Victor II, Gregor, Odin, K.01580 and W.6, grown with Juliana as a standard, are reported, with details of yield, disease resistance, maturity, length and strength of straw, and grain quality. Banco was the most promising variety in the series. Victor II was superior to Juliana, except in its susceptibility to yellow rust [*Puccinia glumarum*]. Other varieties were similar or inferior to Juliana. F.a.s.—A.M.H.

1369 Stoa, T. E. **Wheat varieties for 1958.** *Bi-mon. Bull. N. Dakota Agric. Exp. Sta.* 1958, **20**, No. 3, 11–15.

Recommended wheat varieties for areas in N. Dakota where *Puccinia graminis* is prevalent are the Selkirk, Lee and Conley varieties of hard, red, spring wheat, and the Langdon, Ramsey, Yuma, Towner and Sentry varieties of *Triticum durum*. In relatively rust-free areas, Selkirk, Lee, Conley and Thatcher spring wheats and the Langdon, Ramsey, Mindum and Sentry varieties of *T. durum* are recommended. Rescue and Chinook are recommended for areas where sawfly [*Cephus cinctus*] causes frequent damage.—R.B.

1370 Peterson, R. F. **Twenty-five years' progress in breeding new varieties of wheat for Canada.** *Emp. J. exp. Agric.* 1958, **26**, No. 102, 104–22, bibl. 13, illus.

The types of wheat principally grown in different regions of Canada are summarized. A brief account is given of the situation in 1933 regarding licensing of new wheat varieties, and the main varieties grown. The 33 varieties licensed in Canada in 1933–57 are listed and their origins, performance and status discussed, together with the reasons for their distribution. A short key to these 33 varieties is given. The progress of studies allied to wheat-breeding carried out at several Canadian centres is indicated. Subjects touched upon include : the development of plant-growth chambers ; small-scale testing of new varieties ; and methods for assessing resistance to frost injury, lodging, etc.—A.M.H.

1371 Granstaff, E. L. and others. **Wheat varieties commercially important in**

the hard red winter wheat area. [Revised] *Agric. Ext. Serv., Colorado A. and M. Coll.* [n.d.], pp. 27, bibl. 7, illus.

This publication gives the origin, distribution, and milling and baking characteristics of 18 varieties of hard, red winter wheat. Colour plates and full descriptions of the heads and grain of each variety are given. Areas in the USA recommended for their cultivation are named.—R.B.

1372 HORE, M. L. and SIMS, H. J. **Recommended wheat varieties.** *J. Dep. Agric. Vict.*, 1958, **56**, No. 3, 137–42, illus.

The following varieties are recommended for use in various districts of Victoria : Olympic, Pinnacle, Insignia, Sherpa, Insignia 49, Beacon, Quadrat, Baldmin.—A.M.H.

1373 BROWN, C. W. **Wheat varieties for 1958.** *Agric. Gaz. N.S.W.* 1958, **69**, No. 2, 57–68, illus.

14 varieties recommended for 13 zones of New South Wales are described.—A.M.H.

1374 JANNACCONE, A. I frumenti duri nel mezzogiorno d'Italia. [**Durum wheats in southern Italy.**] *Ital. agric.* 1958, **95**, No. 4, 239–50, illus. [Ist. Agron., Univ. Catania, Sicily]

Italy is self-supporting for soft wheat but imports 500–600 million kg. of durum wheat per year. While the average yield of soft wheat for the last 3 years in Italy was 2082 kg./ha., that of durum wheat was 1156 kg./ha. only. This study, based mainly on durum wheat growing in Sicily (where this type of wheat is almost exclusively grown) gives information on total yield, crop areas, varieties, cultural methods, seed rates and manuring. In Sicily 75% of the durum-wheat area is sown with the varieties Cappelli, Timilia and Garigliano. It is thought that an immediate increase in durum-wheat yields is to be sought not in new varieties but in improving cultivation and manuring (yields of 3000–4000 kg./ha. have been obtained by the author from the varieties now grown). —E.B.O.

1375 HAWKINS, H. S. and BLACK, J. N. **Competition between wheat and three-cornered jack [*Emex australis*].** *J. Aust. Inst. agric. Sci.* 1958, **24**, No. 1, 45–50, bibl. 7, illus. [Roseworthy Agric. Coll., S. Aust.]

1376 ANMA, M. and others. **Studies on the culture of wheat and barley planted after rice in paddy field in Kanto District. 5. Effects of fertilizers on germination of wheat and barley seeds.** [Japanese] *J. Kanto-Tosan Agric. Exp. Sta.* 1958, No. 11, 1–9, bibl. 7, English summary.

Since, in Kanto District, wheat and barley crops are injured by the practice of sowing seeds in direct contact with fertilizer, the effect of various fertilizers on germination of wheat and barley was studied. Ammonium sulphate (150 and 300 kg./ha.), superphosphate (300 and 600 kg./ha.), potassium sulphate (113 and 225 kg./ha.), urea and fused phosphate each retarded germination when the soil-moisture content was 60% or 40% and inhibited germination when it was 40% and the seeds were covered with compost. F.Eng.s.—D.B.

1377 ROANE, C. W. and STARLING, T. M. **Effects of a mercury fungicide and an insecticide on germination, stand, and yield of sound and damaged seed wheat.** *Phytopathology* 1958, **48**, No. 4, 219–23, bibl. 22. [Virginia Agric. Exp. Sta., Blacksburg]

Following reports from Virginia of severe reductions in the germination of seed treated with Hg fungicides, samples of Vahart wheat were either left untreated, or treated with : (a) pyrenone (containing 1·1% piperonyl butoxide + 0·08% pyrethrins) at a rate of 1·125 oz./bu., (b) ceresan M slurry at 0·5 oz./bu., or (c) pyrenone at 1·125 oz./bu. + ceresan M at 0·5 oz./bu. The seed was treated in Aug. and stored until Oct. ; during storage, the seed was subjected to temperatures above 100°F. for a short period. About 33% of kernels were sound, 34% had cracks in the pericarp and 33% had chipped pericarps, with exposed embryos. The seed was germinated in paper towels. Compared with sound seed, seed with chipped kernels germinated slowly and germination percentages were low ; the germination of seed with cracked pericarps was somewhat retarded but not as much as that of cracked seed. Ceresan M greatly retarded the germination of chipped seed and killed a proportion of it. Pyrenone had no detectable effect. In field trials, yields of plants grown from untreated chipped seed, or chipped seed treated with (a), (b), or (c) averaged 37·1, 35·3, 19·6 and 24·8 bu./ac., respectively ; for sound seed, yields were 47·3, 43·6, 45·9 and 35·7 bu./ac., and for the original samples (containing all 3 categories of seed), 41, 39·5, 37·7 and 36 bu./ac., respectively. From these results, it was concluded that treatment with Hg fungicides and the storage of treated seed should be confined to samples containing only low percentages of damaged kernels.—P.J.B.

1378 PETRALIA, L. Un triennio di esperienze di lotta contro la "carie" del frumento. [**Three years' trials to control bunt on wheat.**] *Ann. Sper. agr.* 1958, **12**, No. 2, 651–79, bibl. 61, illus., English summary. [Sta. Sper. Granicolt. Sicilia, Catania, Italy]

Trials were carried out with randomized blocks to test various non-Cu preparations in comparison with caffaro dust, which contains copper oxychloride, for controlling bunt (*Tilletia tritici* and *T. levis*) on wheat. The seed, artificially infected, was treated with the various preparations

at the rate of 200 g. per 100 kg. of seed. Results showed that : (a) all the preparations tested were highly and significantly effective ; (b) the most effective preparations were agrosan G.N., F.B.1, S.65 and pentagran which did not differ significantly among themselves and from caffaro dust. —E.B.O.

1379 Batts, C. C. V. **The reaction of wheat varieties to yellow rust, *Puccinia glumarum*, 1951-1956.** *J. nat. Inst. agric. Bot.* 1957, **8**, No. 1, 7–18, bibl. 12. [N.I.A.B., Cambridge]

The reaction of 93 varieties to yellow rust in the field is summarized. Of the varieties tested, Glasnevin Rosa, Koga, Minister, Peko and Staring were resistant to all races. F.s.—A.M.H.

1380 Hartman, T. A. Jarowisatie onderzoek in '56. [**Investigations on vernalization, 1956.**] *Jaarb. Inst. biol. scheik. Onderz.* 1957, 117–21, English summary and table headings.

The optimal duration of vernalization for Staring winter wheat is probably not much over 30 days, for Petkus winter rye it is perhaps much longer. A temperature of 0°C. has a slight effect on Petkus rye and none at all on Staring wheat. A temperature of 5°C. has a better effect than 2·5°C. ; for rye the optimal vernalization temperature seems to be not much over 5°C., for Staring wheat it is probably much higher. For practical purposes, however, temperatures lower than the optimal must be used if the seed is to be kept in condition for sowing. Weather conditions at the beginning of flowering in the mother plants appear to exercise an influence on the sensitivity to vernalization of the seed taken from these plants. —G.M.R.

1381 Ahrens, J. F. **Vernalization and photoperiodism of winter wheat.** *Diss. Abstr.* 1957, **17**, No. 12, 2776. [Iowa State Coll., Ames]

Subjecting seed of winter wheat (var. Minter) to 1°C., or the plants to 7°C., for more than 2 weeks decreased the time taken to reach the heading stage under long days at 75°F. Treatment of the seed for 9 weeks at 1°C. and the plants for 6–10 weeks at 7°C. resulted in the shortest times taken to reach the heading stage. Vernalizing seed for 19 weeks resulted in as few as 5 leaves being formed before heading. Vernalization of seed at −2°C. failed to produce early heading. Short (11-hr.) photoperiods promoted floral induction more when applied before or between vernalizing treatments, than when applied during vernalizing treatments up to 6 weeks in duration. Long photoperiods (18 hr.) during a vernalizing period of 10–14 days accelerated the heading of Pawnee and Turkey wheats under 13-, 14-, or 18-hr. photoperiods at 20–24°C. and of Queen and Minter wheats under 18-hr. photoperiods. Where no vernalizing treatments were made, no inductive effects in Minter or Turkey wheats followed the use of 11-, 13-, 15·5-, or 18-hr. photoperiods for a 6-week period. Short photoperiods (11 hr.) after vernalization resulted in increases in spikelet primordia numbers, spike lengths and numbers of tillers and leaves. Gibberellic acid promoted the vegetative growth of unvernalized wheat, but not its induction or initiation.—P.J.B.

1382 Anma, M. and Shikata, S. **The effects of vernalization on the growth and yield of wheat.** [Japanese] *J. Kanto-Tosan Agric. Exp. Sta.* 1958, No. 11, 10–19, English summary.

Seeds of winter- and spring-varieties of the Norin series were sprouted at 10–20°C. and vernalized at 1–2°C. during which the water content of the grain was maintained at 60% of dry matter. Subsequent development was compared with that of unvernalized plants. After vernalization, the heading date was brought forward and grain yields increased. Since vernalization also caused a shortening of the lower internodes, it should increase resistance to lodging. F.Eng.s.—D.B.

1383 Schuurman, J. J. and de Smet, L. A. H. De wortelontwikkeling van zomertarwe op verschillende Dollardkleiprofielen. [**Root development of spring wheat on some Dollard clay profiles.**] *Boor en Spade* 1957, **8**, 73–83, bibl. 6, illus., English summary.

The growth of spring wheat was observed on 4 soils : (1) sticky clay poor in Ca overlying peat ; (2) compact clay poor in Ca overlying sandy clay rich in Ca overlying peat ; (3) compact clay poor in lime overlying deep, calcareous clay ; (4) deep, heavy clay rich in lime. The total quantity of wheat roots was related to the lime content. Root concentration was greatest in the topsoil, and decreased with increasing depth. The greatest quantity of wheat roots occurred in profile 2. The crop was poorest on profile 1, better on profile 2, and best on profiles 3 and 4. Maximum depth of rooting was of more importance in producing high grain yields than was the total quantity of roots ; the latter showed some relationship with straw yield. F.s.—R.B.

1384 Michael, G. and Marschner, H. Untersuchungen über die Phosphat-Abscheidung aus Pflanzenwurzeln mit Hilfe von P^{32}. [**A study of the excretion of phosphate from plant roots with the aid of ^{32}P.**] *Z. PflErnähr. Düng.* 1958, **80**, No. 1, 1–18, bibl. 27. [Agric. Chem. Inst., Univ. Jena, E. Germany]

Under normal conditions, the quantity of P excreted from wheat roots was negligible, being 0·2% of the total plant P. When excess CO_2 surrounded the root surfaces, the loss of P was considerable—up to 12% of the total plant P. This loss could occur in a compact soil with little aeration.—D.B.

1385 Malato-Beliz, J. and Baptista, J. G. Sobre a determinação da característica "densidade" em espigas de trigo. [**The determination of ear "density" in wheat.**] *Melhoramento* 1957, **10**, 33–46, bibl. 25, English summary.

Comparison was made between Neergaard's method, in which ear density is expressed as a function of the number of spikelets and the total length of the rachis, and Ubisch's method, in which it is based on the average length of the internodes in the middle third of the rachis. It was shown that the latter method is superior to the former because of less variation in the density values obtained.—E.B.O.

1386 Hkan, H. C. and others. [**A study of phasic development of wheat grown in the Kwangtung Province.**] [Chinese] *Acta bot. sinica* 1957, **6**, No. 3, 245–58, bibl. 8, illus., Russian summary.

1387 Korocteleev, I. Ja. [**The effect of autumn light on earing in winter wheat.**] [Russian] *Agrobiologija* (*Agrobiology, Moscow*) 1958, No. 3, 60–4, bibl. 26. [Agric. Inst., Har'kov]

The significance for earing of daylength, and the number of days which elapse from seedling emergence to tillering, is considered.—M.H.

1388 Agaev, M. G. [**Changes in the reaction of spring wheat varieties under the influence of conditions of development.**] [Russian] *Doklady Akad. Nauk SSSR* (*Proc. Acad. Sci. USSR*) 1958, **118**, No. 6, 1197–9, bibl. 10. [Dagestan State Univ.]

Experiments with varieties of *Triticum vulgare* and *T. turgidum* show that while phasic characteristics of the plants change under the influence of environmental conditions which are abnormal for the variety concerned, the changed character becomes heritable only under specific conditions of light and/or temperature.—M.H.

1389 Schmalz, H. Der Einfluss alternierender Kurztag- und Dauertag-Perioden verschiedener Länge auf die generative Entwicklung einiger Sommerweizenformen. [**The effect of varying the duration of alternating short-day and continuous-day periods on the reproductive development of some spring-wheat varieties.**] *Z. PflZücht.* 1958, **39**, No. 1, 97–112, bibl. 38, illus. [Martin-Luther-Univ., Halle-Wittenberg in Hohenthurm, E. Germany]

During the stage between emergence and 6 weeks' growth, 4 wheat varieties were subjected to alternating short day (10 hr.) and continuous day. The periods of continuous day and short day were changed (a) daily, (b) every 3 days, (c) every 7 days. The rapidity of development of reproductive organs increased in this same order. All varieties reacted similarly, although each was endowed with a different critical day-length. The theory is advanced that the production of the flowering hormone is disturbed (or intensified) to a different extent by the rapidity of the alternation.—D.B.

1390 Nanda, K. K. and Chinoy, J. J. **The influence of the temperature of ripening period and the grain weight on the yield of wheat.** *Phyton* 1958, **10**, No. 1, 43–50, bibl. 7, Spanish summary. [Dep. Bot., Univ. Delhi, India]

Seedlings of 3 varieties of wheat, which had been germinated in Petri dishes, were exposed to various photoperiodical treatments for 12–14 days. They were then transplanted and kept under short day, normal day and long day. Plants under short day showed, in general, the shortest ripening period (mean period between date of anthesis and date of full-ripe stage). The ripening period lengthened with normal-day plants, and was longest with long-day plants. As the ripening periods lengthened, the mean maximum temperatures for this period (calculated from meteorological records) fell. A highly significant inverse correlation was found between the length of the ripening period and the mean maximum temperature of this period, indicating that the latter had a profound effect on the grain-filling processes. This was substantiated by a highly significant positive correlation between the 1000-grain weight and yield per plant. The correlation between the mean maximum temperature during the ripening period and grain yield per plant was not significant, indicating that the effect of the maximum temperature of the ripening period on grain yield was masked by other factors.—E.B.O.

1391 Fajersson, F. Oldingsåtgärder för kvalitetsförbättring av vetet. **Cultivation methods for quality improvement in wheat.** *Sverig. Utsädesfören. Tidskr.* 1957, **67**, 4/5, 260–70, bibl. 2, English summary.

Summarized data are given of the milling and baking qualities of the winter wheats Eroica, Skandia III B, Banco and Svale, grown in S. Sweden, and of Odin, Ergo and Ertus, grown in central Sweden and of the spring wheats Kärn II, Diamant II, Svenno and Drott. Of varieties grown in S. Sweden, Eroica, followed closely by Banco, had the highest volume weight, followed by Svale and Skandia III B. Banco had the best bread volume. Dough weight was highest in Eroica, followed by Banco. Skandia III B had a very low dough weight. Eroica, Banco and Svale had good milling qualities, but Skandia III B was unsatisfactory in this respect. Of varieties grown in central Sweden, Odin had considerably better baking quality than Ergo, but both were inferior to Ertus, though the relatively poor straw-stiffness of Ertus has limited its use in practice. Of spring wheats, the old standard variety Diamant II competed well with the new varieties Kärn II and

Svenno, both in volume weight and protein content. Kärn II had the highest bread volume, followed closely by Svenno. The dough weight of Diamant II and Svenno was slightly, but significantly, higher than that of Kärn II. The milling quality of currently-grown Swedish spring wheats is regarded as highly satisfactory ; the dangers of introducing foreign wheats, such as Peko, is stressed. The effect of cultural factors on wheat quality is reviewed. Early sowing and the avoidance of too high plant populations enhance quality. Heavy P treatments have reduced the protein content of the grain and adversely affected baking quality. Heavy N treatments considerably increased volume weight and protein content ; the effect of late applications of calcium nitrate was particularly favourable. Late harvest resulted in severe reductions in volume weight and increased diastatic activity.—P.J.B.

1392 Lindberg, J. E. Föradlingsindustrins kvalitetskrav på vete samt erfarenheter från kvalitetsundersökningar. **Industrial requirements in regard to wheat quality and some results of the quality investigations.** *Sverig. Utsädesfören. Tidskr.* 1957, **67**, No. 4–5, 222–42, English summary.

Among quantitative requirements for good milling quality in wheat reviewed are the following: moisture content, purity, flour yield, grain condition and ripeness, and freedom from Hg-containing seed-treatment chemicals. The necessity for incorporating fluorescent materials into seed-treatment chemicals in Sweden is stressed. The value of hectolitre weight as a quantitative index of grain quality is critically considered. Qualitative indices of grain quality discussed include : diastatic activity, with observations on the use of the Molin number and factors such as sprouted grain which affect it, and protein content and flour-particle size.—P.J.B.

1393 Bell, G. D. H. and Bingham, J. **Grain quality—a genetic and plant-breeding character. 1. Wheat.** *Agric. Rev., Lond.* 1957, **3**, No. 6, 10–22, bibl. 17, illus. [Pl. Breeding Inst., Cambridge]

1394 Carles, J. and Bourguet, Marguerite. Les acides organiques du blé. [**The organic acids of wheat.**] *C.R. Soc. Biol., Paris* 1957, **151**, No. 2, 383–7, bibl. 3. [Lab. Physiol. Veg., Inst. Cath. Toulouse]

The organic acids in the leaves, stems, roots, ears and grains of wheat were studied during the principal stages of plant development by paper chromatography.—E.B.O.

1395 Fernandes, S. J. G. and Tavares, Maria M.S.V.S. Aminoácidos indispensáveis em algumas formas cultivadas de trigo. [**Essential amino acids in some cultivated forms of wheat (in Portugal).**] *Melhoramento* 1957, **10**, 23–32, bibl. 12, English summary.

1396 Price, C. D. and Klingman, G. C. **Wheat and oats varietal responses to applications of alkanolamine salt of 2,4-D.** *Agron. J.* 1958, **50**, No. 4, 200–4, bibl. 13. [N. Carolina State Coll., Raleigh]

The responses of 27 winter-wheat and 29 winter-oat varieties to applications of 0·5 and 2 lb. a.e. of 2,4-D amine/ac. applied in November during early tillering or in March at the fully-tillered stage were studied. All wheat varieties were more susceptible to 2,4-D at early tillering than when fully tillered. The greatest differences in varietal response of both wheat and oats occurred with the 0·5 lb. application at early tillering. Coastal, Knox and Travis wheats were not affected by any of the treatments. The most susceptible wheat varieties, F.W. 717–43, Cokers 47–27 and Purplestraw were the only wheats reduced in yield by either application at the fully-tillered stage. Reductions in yield occurred in a large number of oat varieties treated with 2,4-D at 2 lb./ac. at the fully tillered stage. The only oat varieties reduced in yield by late application of 2,4-D at 0·5 lb./ac. were Trispernia × Lemont–2542, Stanton Strain 1 and Atlantic × (Cl² × S.F.) 2288–96. The early 2-lb. treatment severely reduced yield and height at maturity in most oat varieties. Arlington, Pentagon × Landhafer—820, Wintok × Landhafer–712, Bronco, C.I. 6575–2264 and Fultex oats were not reduced in yield by any treatment. F.S.—R.B.

1397 Hunter, A. S. and others. **The effect of nitrogen fertilizers on the relationship between increases in yields and protein content of pastry-type wheats.** *Agron. J.* 1958, **50**, No. 6, 311–14, illus. [Oregon Agric. Exp. Sta. and West. Soil and Water Man. Br. U.S.D.A.]

Since the baking quality of soft, pastry-type wheats is impaired when their protein content rises above 10% the consequences of fertilizing with nitrogen in the Oregon dryland areas was examined. Grain protein was not raised to undesirable levels until more N was applied than was needed to produce maximum grain yields because, up to this point, yields increased more rapidly than the protein contents. With still larger N application, the grain protein increased more rapidly than yield.—M.H.F.

1398 Ikeda, T. and others. **The effect of foliage spray of urea on the wheat injured by excess-moisture in the soil.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1957, No. 4, 38–48, bibl. 11, English summary.

Norin 53 wheat grown on lowland soil was given excess moisture in February ; plant injury was observed as leaf yellowing in late March about a month before heading. 1·5% urea solution was sprayed on the leaves at the rate of 0·6 kan N/tan.

Recovery of leaf colour was observed within 3–5 days and became noticeable in 8–12 days after application of the first spray on 28 March. Later sprayings on 17 April and 1 May, had no noticeable effect. The same quantity of N applied to the soil as $(NH_4)_2SO_4$ had little effect. [1 kan = 3·75 kg. ; 1 tan = 0·099 ha.] F. Eng. s.—D.B.

1399 Aufhammer, G. Stand und Möglichkeiten der Qualitätsweizen-Erzeugung. [**Present position in and prospects for the production of high-quality wheat.**] *Bayer. landw. Jahrb.* 1958, **35**, No. 2, 131–43. [Weihenstephan]

1400 Baker, G. A. and Roessler, E. B. **Implications of a uniformity trial with small plots of wheat.** *Hilgardia* 1957, **27**, No. 5, 183–8, bibl. 6. [California Agric. Exp. Sta., Davis]

OATS

See also Abs. 1367, 1396, 1727, 1779, 1844

1401 Aguado, Mercedes. La avena. [**Oats (in Spain).**] *Hojas divulg. 2-58 H Minist. Agric. Spain* 1958, pp. 16, illus.

1402 Montaruli, A. La coltura dell'avena in Puglia e Lucania. Un triennio di esperienze sulla concimazione fosfo-azotata. [**Oat-growing in Puglia and Lucania (southern Italy). Three years' trials on N-P manuring.**] *Ann. Fac. Agr., Bari* 1957, **11**, 49–82, bibl. 18, English and French summaries.

The oat area of Puglia and Lucania, about 185,000 ha., is being gradually reduced because of the preference given to wheat-growing. Oat is a neglected crop yielding only 1000–1200 kg. of grain per ha. There is, however, a considerable demand for oat grain which is used mainly for feeding horses. Information is given on methods used for growing oats and on varieties, which are of the autumn type. In the trials described, carried out in a soil low in N and P, N increased yields by about 300 kg./ha. for every 100 kg. of ammonium nitrate applied, while the effect of P was small. Early manuring in winter was more effective than late applications.—E.B.O.

1403† Ono, S. [**The effect of date and rate of planting and of cutting on grain production of fall-sown oats.**] [Japanese] *Proc. Crop Sci. Soc. Japan* 1957, **26**, No. 2, 150–1, bibl. 3, English summary. [Chūgoku Agric. Exp. Sta.]

When grown for forage, the yields from clipped plots of oats [date of clipping not given in summary] were highest when sown in mid-October, slightly lower when sown in late September and considerably lower when sown in November. Grain yields from clipped plots were highest when oats were sown in September and were significantly lower when sown in October. There was no significant difference in grain yield from unclipped plots whether oats were sown in September or October. The grain yields from clipped plots were lower than from unclipped plots ; after sowing in October and November this difference was highly significant. The recommended sowing date for both forage and grain is late September and for grain only [or for forage production only], mid-October. For all purposes the best sowing rate was 6 sho per tan. [1 tan = 0·245 ac. ; 1 sho = 1·8 l.]—D.B.

1404† Pendleton, J. W. and Dungan, G. H. **Effect of row direction on spring oat yields.** *Agron. J.* 1958, **50**, No. 6, 341–43, bibl. 6. [Illinois Agric. Exp. Sta., Urbana]

Oats drilled in a N–S direction yielded better than those drilled E–W and the advantage increased as row spacings widened. NE–SW drillings did not differ from NW–SE drillings. Counts of interplanted clover were higher in E–W than in N–S rows and, in dry years, clover yields increased with the wider oat sowings. Moisture between drills was slightly higher for E–W than for N–S drillings and clover numbers were correspondingly increased. Clover distribution between oat rows was more uniform with N–S drillings. Soil moisture was highest in the middle of the oat row spaces. N–S rows of oats admitted more light to the interplanted clover in the middle of the day than E–W rows but less in the morning or the evening.—M.H.F.

1405 Scottish Agriculture. **Two oat varieties.** *Scot. Agric.* 1958, **37**, No. 4, 202.

Two new varieties of oats, Deva and Pendek, were compared with Sun II and were both inferior to it in grain yield and straw strength.—A.M.H.

1406 Andersen, T. Forsøg med havresorter 1935–1954. [**Trials with oat varieties, 1935-1954.**] *Tidsskr. Planteavl* 1957, **61**, No. 4, 667–84.

A brief review is given of the results of varietal trials with oats in Denmark during 1935–48, followed by a more detailed account of trials during 1949–54. In trials at 11 locations in mineral soils during 1949–54, Pajbjerg Rex A gave the highest average grain yield of 43·1 hkg./ha., followed by Borris Opus II, Svalöf Stål A [Svalöf Steel A] and Svalöf Ørn E [Svalöf Eagle E] with 42·4, 42·3 and 42 hkg./ha., respectively. In trials during 1953–4, Abed Max (636), Trifolium 52/1 and Tammisto Sisu gave average yields of 45·4, 42·2 and 42·1 hkg./ha., respectively. On fen, low-moor and high-moor peat soils, Abed Max gave the highest mean yields in 2 years' trials, with 46·5 hkg./ha. followed by Pajbjerg Rex A and Pajbjerg Regent, both of which yielded 2·3 hkg./ha. less grain than Abed Max. Data are also given of grain quality and straw yields. Brief descriptions are given of the above varieties, together with Abed Palu.—P.J.B.

1407 Telneset, S. Beskrivelse og klassifisering av 18 havresorter. [**Description and classification of 18 oat varieties.**] *Meld. Stat. Frøkontroll Ås 1956–1957* [n.d.], 27–60, bibl. 27, illus.

A key, based on stem, leaf, panicle and grain characteristics, is given for the identification of the following varieties : Voll, Nidar II, Pendek, Kytø, Jøtul, Tempe, Guldregn II (Golden Rain II), Marne, Blenda, Blixt, Sol II (Sun II), Merkur, Hein II, Max, Strind, Sisu, Bambu and Palu. Agronomic characters are briefly noted and illustrations are given of the panicle of each variety. —P.J.B.

1408† Brown, C. W. **Oat varieties for 1958.** *Agric. Gaz. N.S.W.* 1958, **69**, Pt 1, 2–8, illus.

Varieties of oats for grazing, grains and grain plus grazing are described and recommendations made for the different districts.—M.H.F.

1409 Grabe, D. F. **Laboratory methods for identification of varieties of soybeans and oats.** *Iowa State Coll. J. Sci.* 1957, **32**, No. 2, 179–80. [Received May, 1958]

In laboratory tests, oat varieties could be divided into 2 main groups on the basis of fluorescence of the lemma ; no distinctive differences in root fluorescence were found. With soyabeans, the fluorescence test was of no diagnostic value. Physiological tests, such as photoperiodic reaction and diffusion-pressure deficit measurements were valueless for distinguishing between varieties of oats. Oat varieties could be distinguished by their reaction to races 7, 7A and 8 of *Puccinia graminis avenae*, races 203, 216 and 232 of *P. coronata* and to *Helminthosporium victoriae*. Distinctions between soyabean varieties could be made on the basis of their reaction to 3 isolates of *Peronospora manshurica*. —P.J.B.

1410 Frey, K. J. and others. **Dry weights and germination of developing oat seeds.** *Agron. J.* 1958, **50**, No. 5, 248–50, bibl. 14. [Iowa Agric. Exp. Sta., Ames]

The consequences of premature harvesting of oats upon germination and moisture contents of seeds and upon the weights of seeds and seedlings were studied with 7 varieties of oats. Near-maximum seed weight was obtained when grain contained approximately 45% water. Germination increased with maturity up to 20–28 days after anthesis ; a few seeds germinated as early as 4–6 days after anthesis. Seedling weights were closely correlated with seed weights but the plants, at maturity, developed to the same size regardless of the size and age of the seed when harvested. A pregermination chilling for 10 days at 4°C. considerably improved germination percentages, especially in Garry oats which exhibited a post-harvest dormancy.—M.H.F.

1411 Frey, K. J. and Wiggans, S. C. **Tillering studies on oats : 4. Effect of rate and date of nitrogen fertilizer application.** *Proc. Iowa Acad. Sci.* 1957, **64**, 160–7, bibl. 7. [Iowa Agric. Exp. Sta., Ames]

The tillering response of 12 oat varieties to N applications on soil adequately supplied with P and K, but poor in available N, was investigated. In most varieties, N applications caused an increase in tillering. Applications of 40 lb./ac. produced the maximum number of tillers per plant in the varieties Marion, Park, C.I. 5298 and Simcoe. Where N applications were delayed for 2, 4 or 6 weeks, 1·31–1·33 tillers per plant were produced, compared with 1·18 where N was applied at sowing time. Delays of 1 or 2 weeks in applying N increased tillering ; a delay of 3 weeks gave no further increase. Therefore, maximum tillering appeared to be determined during the first 2 weeks. Conditions favourable to rapid growth tended to inhibit tillering. N applications tended to stimulate tiller growth rather than the development of additional tillers. [See also Abs. 487.]—R.B.

1412 Grafius, J. E. **Observations on the lodging resistance formula.** *Agron. J.* 1958, **50**, No. 5, 263–4, illus., bibl. 1. [Michigan State Univ., E. Lansing]

The earlier estimate of lodging resistance worked well within morphologically similar varieties but occasionally poor agreement was observed. For 11 varieties of oats in this aberrant group the moment of force about the base of the culm caused by wind pressure on the heads, was determined and found to be a major factor determining lodging.—M.H.F.

1413 Albritton, D. J. and Ellis, R., Jr. **Influence of organic matter and certain anions on the yield and phosphorus content of oats.** *Agron. J.* 1957, **49**, No. 8, 410–12, bibl. 16, illus. [Kansas Agric. Exp. Sta., Manhattan]

Oats of the variety Mo 0–205 were grown in a greenhouse in soil treated with one of the following: 4000 ppm. of (a) ground (>40 mesh) oat-straw, (b) ground lucerne hay ; 1000 ppm. of (c) oxalate, (d) citrate, (e) tartrate, and (f) silicate, applied as Na salts. Yields and P uptake were increased significantly more by (f) than by most other treatments, despite the P content of treatments (a) and (b), showing that silicate ions could make soil P available to oats. A second experiment consisted of treatments of 0, 500 and 1000 ppm. silicate, as Si_2O_5, in combination with 0, 15 and 30 ppm. P_2O_5. In the absence of applied P, treatment with silicate gave results similar to those obtained in the first experiment. Where 30 ppm. P_2O_5 was added, silicate treatments resulted in significant increases in P uptake, compared with 30 ppm. P_2O_5 and no silicate. F.S.—R.B.

1414 ALDRICH, R. J. **Effect of 2,4-D on the growth and yield of oats grown under three levels of fertility.** *Agron. J.* 1958, **50**, No. 3, 145–8, bibl. 11. [New Jersey Agric. Exp. Sta., New Brunswick]

Clinton oats were grown for 5 yr. (a) unfertilized, (b) with 10–10–10 (NPK) at 300 lb./ac. in 1952 and '53 and 250 lb./ac. in '54, '55 and '56, (c) with 10–10–10 at 600 lb./ac. in '52 and '53 and 500 lb./ac. in '54, '55 and '56. The crops were sprayed with the triethanolamine salt of 2,4-D at 1 lb./ac. (1) at the 2- to 3-leaf stage, (2) when fully tillered but before jointing, (3) at anthesis. Yields of (a) were not appreciably affected by treatment. Yields of (b) were reduced most by (1) and significantly reduced by (3). Yields of (c) were significantly reduced by (3) only. Yield reductions were correlated with reductions in number of seeds per tiller. Treatment (1) significantly increased the average number of tillers in (b) and (c). Treatment (2) significantly increased the average seed weight of (c). F.s.—R.B.

1415 PUCKRIDGE, D. W. **Results from manganese with oats on Eyre Peninsula.** *J. Dep. Agric. S. Aust.* 1958, **61**, No. 9, 433–5, illus.

Plots receiving 80 lb. superphosphate only per ac. yielded 25 bu./ac., while those receiving in addition 28 lb. $MnSO_4$/ac. yielded 32 bu./ac. When Cu and Zn were also used, yields were 32·6 bu./ac. at 14 lb. $MnSO_4$/ac. and 34·8 bu./ac. at 28 lb. $MnSO_4$/ac. Zn, or Cu + Zn, alone, did not significantly affect yields.—A.M.H.

RYE

See also Abs. 1380, 1432, 1719, 1720, 1726, 1727, 1852

1416 LINNOMÄKI, H. Syysrukiin kylvöaikakokeet Hämeen Koeasemalla. **Sowing-time trials with winter rye at Häme Experimental Station.** *Maatal. ja Koetoim.* 1958, No. 12, 147–53, English summary. [Häme Exp. Sta., Pälkäne, Finland]

The last week in August is the most suitable time for sowing this crop on sandy soil in the area of the above Station. F.Eng.s.—M.H.

1417 ANTTINEN, O. Syysrukiin kylvöaikakokeet pohjois-Pohjanmaan koeasemalla. **Sowing-time trials with winter rye at North Pohjanmaa Experimental Station.** *Maatal. ja Koetoim.* 1958, No. 12, 154–8, English summary. [North Pohjanmaa Exp. Sta., Ruukki, Finland]

The results of 15-years' sowing trials show that the last 10 days of August are the most suitable sowing dates for this crop in the area concerned. F. Eng. s.—M.H.

1418 VALLE, O. Kylvöajan merkityksestä syysrukiin ja syysvehnän viljelyssä etelä-Suomessa. **The influence of sowing time on the cultivation of winter rye and winter wheat in South Finland.** *Maatal. ja Koetoim.* 1958, No. 12, 159–76, illus., English summary. [Agric. Res. Centre, Tikkurila, Finland]

According to trials carried out during 30 years, the most suitable sowing time for winter rye in S. Finland is the last week in August, and for winter wheat, the end of August-beginning of September. F. Eng. s.—M.H.

1419 HONKAVAARA, T. Syysviljojen kylvöaikakokeet etelä-Pohjanmaan koeasemalla. **Trials on sowing date for winter cereals in the South Pohjanmaa Research Station.** *Maatal. ja Koetoim.* 1958, No. 12, 177–87, illus., German summary. [S.P. Res. Sta., Ylistaro, Finland]

These trials have been in progress since 1933. The data for rye cover 21 years and for wheat, 5 years. When considering avoidance of infestation by *Oscinella frit* and also the reduction in yields which result from late sowings, it is concluded that, on average, the best sowing date for both these crops is approx. 28 August. F. Ger. s.—M.H.

1420 BANNEICK, A. Anbauversuche mit tetraploidem Roggen auf verschiedenen Standorten Mitteldeutschlands. [**Cultivation trials with tetraploid rye on locations with different environments in Central Germany.**] *Z. Acker- u. PflBau* 1958, **105**, No. 2, 226–38, bibl. 4, illus., English summary. [Inst. Acker- u. PflBau, Halle-Wittenberg, E. Germany]

On loamy soils, strains of tetraploid rye gave grain yields similar to those of diploid Petkuser Normal rye, but on sandy and heavy clay soils they gave lower yields. The tetraploids suffered considerably from lodging after heavy rainfall. In sowing-rate trials, 180–200 kg./ha. was optimum for light soils, but on a heavier soil, varying the sowing rate between 150 and 220 kg./ha. produced no significant difference in yields. Increasing N-applications gave approximately the same increases in grain yield of both diploid and tetraploid rye. A split application of N at 120 kg./ha. increased stand density and yield per ear of tetraploid rye.—D.B.

1421 ALBERTSSON, C. E. Kvalitetskrav på rågen som brödsäd. **Quality demands in rye for bread-making.** *Sverig. Utsädesfören. Tidskr.* 1957, **67**, No. 4/5, 243–50, illus., English summary

Different indices of quality in rye grain are considered. The need for a more rapid and inexpensive method of indicating diastatic activity than the Molin technique is stressed. Observations are given on data from Molin unit determinations made on samples of foreign and Swedish rye and on Swedish rye harvested in different years.—P.J.B.

1422 VAN DOBBEN, W. H. Late stikstofoverbemestingen op granen : De instituutsproeven van het C.I.L.O. met rogge in 1956.

[Late additional nitrogen applications on cereals : Central Institute for Agricultural Research official trials with rye in 1956.] *Stikstof* 1957, No. 14, 43–8, illus.

Winter rye was grown on recently-reclaimed heathland fertilized with 60 kg. N/ac. Additional N at 20 or 40 kg./ha. was applied at the emergence of (a) the last but one leaf, when the crop was 30 cm. tall ; (b) the last leaf ; (c) the ear. There were no significant differences in grain yields between the treatments. The straw was not lengthened by any treatment, though its weight was increased. The control plot yielded 2720 kg. grain/ha. ; 20 kg. late-applied N increased yields by 600 kg./ha., while 40 kg./N increased yields by 1000 kg./ha. The grain/straw ratio was raised from 0·5 to 0·6 by the late N-applications. A further experiment was carried out on old arable land regularly receiving f.y.m. to compare the yields following late applications of 20 kg. N/ha. with those following 20 kg. N/ha. applied in early spring, combined with basal applications of 20, 40 and 60 kg. N/ha. Increases in yield from late applications were scarcely half of those from early applications and were about half of the increases obtained on heathland. The probable reason is that early in the season available N is almost completely used up for vegetative growth. When the crop comes into ear it still requires some N which, on old arable land, is provided by the breakdown of organic matter in the soil. Interprovincial trials in 1955 and '56 showed that there were few sandy soils on which crops did not respond to late applications of N ; crop responses were much less marked where control yields were already high. There was a tendency for high yield increases following late applications of N to be associated with soils of low fertility and crops with a low grain/straw ratio.—R.B.

BARLEY

See also Abs. 1376, 1720, 1727, 1730, 1734, 1790, 1791, 1834, 1844, 1852, 1854

1423 Troubetzkoï, —. L'orge de brasserie. **[Malting barley.]** *Potasse* 1958, **32,** No. 254, 92–3.

Information is given on the production, sowing, varieties, manuring and harvesting of malting barley in France.—E.B.O.

1424 Day, A. D. and Dickson, A. D. **Effect of artificial lodging on grain and malt quality of fall-sown irrigated barley.** *Agron. J.* 1958, **50,** No. 6, 338–40, illus., bibl. 8. [Arizona Agric. Exp. Sta. Tucson and Bailey and Malt Lab., U.S.D.A.]

Artificial lodging, at 45° and 90° from the vertical, was induced in spring barley, grown under irrigation as a winter annual, at heading and at 10 and 20 days after heading in the varieties Atlas 46 and Hannchen. Artificial lodging at 45° had little effect on barley and malt qualities. Lodging at 90° increased the barley and malt N, wort N as a percentage of the dry malt and, to a lesser extent, malt diastatic power and α-amylase activity. Barley and malt kernel weights and malt extract percentages were all decreased by severe lodging but neither wort N/malt N nor β-amylase/α-amylase ratios were appreciably influenced. Lodging 10 or 20 days after heading had a more detrimental effect on barley and malt quality than if it had occurred at heading, Atlas 46 being affected more at 10 days and Hannchen at 20 days after heading.—M.H.F.

1425 Ikeda, T. and others. **Effect of excess-moisture in the soil on the growth of barley at various stages.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1957, No. 4, 30–7, bibl. 21, illus., English summary.

The effect of flooding barley, for a period of 20 days, at various growth stages was investigated. So far as effect on yield is concerned, barley suffered the greatest loss in yield when given excess moisture at the boot stage, and the internode-elongation stage, the effect being delay in heading, a shorter culm and a less plump kernel. There was also a yield decrease when flooding took place in the early ripening-stage, the effect being premature wilting of the plant and withering of kernels. F.Eng.s.—D.B.

1426 Travers, S. J. and Webster, T. **N.A.A.S./N.I.A.B. spring barley variety trials : 1951-1954.** *J. nat. Inst. agric. Bot.* 1957, **8,** No. 1, 50–61, bibl. 4.

Results of 84 field trials of spring barleys are reported. Main varieties included were : Carlsberg, Freja, Herta, Kenia, Proctor and Rika. Comments are given on these and 7 subsidiary varieties. Herta, Proctor and Rika yielded most and, of the main varieties, they had the stiffest straw. F.s.—A.M.H.

1427 Eade, A. T. **Spring barley variety trials, 1951-1956.** *J. nat. Inst. agric. Bot.* 1957, **8,** No. 1, 36–49, bibl. 2.

Field trials during the period 1951–6 are reported for the spring barley varieties Agio, Beorna, Bonus, Bonus II, Domen, Drost, Fero, Haisa II, Heimdal, Kron and Busser, grown with Kenia as a standard in 1951–3 and with Proctor in 1954–6. In 1955, trials which included 3 levels of N treatment were introduced. Bonus, Bonus II, Kron and Heimdal closely approached Proctor in yield. All varieties, except Fero, matured earlier than Proctor. Haisa II, the earliest, showed good resistance to mildew [*Erysiphe graminis*], but had long and weak straw. Domen was more resistant to lodging than Proctor. Loose smut [*Ustilago tritici*] did not occur on Agio, Bonus and Domen.

Results of small-scale malting tests are described. F.s.—A.M.H.

1428 Inamura, H. and others. "**Musashinomugi," a newly bred early variety of barley.** [Japanese] *J. Kanto-Tosan Agric. Exp. Sta.* 1958, No. 11, 36–48, illus., English summary.

This new variety heads 6 days earlier and matures 4 days earlier than Sekitori (one of its parents). Its cold resistance is similar to Sekitori. Because of high resistance to lodging and mildew it can stand heavy fertilization. The grain is small and of good quality. Musashinomugi is superior to Satsukimugi, except for date of heading and of maturing. It is suitable for preceding tobacco and vegetable crops in a rotation and is recommended for Ibaragi, Tochigi, Saitama, Tokyo, Chiba, and Kanagawa Prefectures to replace Satsukimugi, Suifu and Bozu. F.Eng.s.—D.B.

1429 Mitchell, F. S. and others. **Influence of the enclosing protective tissues on the metabolism of barley grain.** *Nature, Lond.* 1958, **181,** No. 4618, 1270–1, bibl. 10. [N.I.A.E., Silsoe, Beds]

The authors' study of mechanically-damaged barley grain confirms the view that the testa acts as a semi-permeable membrane controlling the intake of solutes, while the husk and pericarp are intimately connected with dormancy in barley. It is concluded that the physical condition and function of the protective tissues enclosing the grain largely determine the grain's maximum life-span and the vigour with which its embryo germinates at any given time within that period.—M.H.

1430 Stelter, J. and others. Einfluss von Ultraschall auf die Keimung von Saatgut und die Entwicklung der Pflanze sowie Prüfung der Verwendungsmöglichkeit des Ultraschalls in der Phytopathologie. [**Effect of ultrasonic waves on seed germination and plant development, also a test of the possibility of using ultrasonic waves in phytopathology.**] *NachrBl. dtsch. PflSchDienst. (Braunschweig)* 1957, **9,** No. 11, 166–70, bibl. 11, illus. [Tech. Hochsch. Aachen]

Ultrasonic waves increased the rate of imbibition in barley seed and consequently brought about more rapid germination, but this cannot at present be regarded as a practical method for increasing the rate of germination.—D.B.

1431 Pollock, J. R. A. **Growth substances in relation to dormancy in barley.** *Chem. and Industr.* 1958, No. 13, 387–8, bibl. 5. [Brew. Industr. Res. Found., Nutfield, Redhill, Surrey]

A summary is given of results from laboratory investigations into dormancy in barley carried out during the past 3 years. With very dormant samples which failed to germinate even after dehusking, the decorticated grains germinated rapidly when moistened with dilute solutions of gibberellic acid but not with solutions of kinetin. In many cases treatment with gibberellic acid, or with hydrogen sulphide, alone, failed to promote the germination of all intact grains, but mixtures of these 2 substances were fully stimulatory. Grain which was less markedly dormant responded readily to either gibberellic acid or hydrogen sulphide. The samples responding most readily to gibberellic acid also germinated when moistened with solutions of kinetin but when the minimum concentration of gibberellic acid necessary for germination was 100 ppm., many grains failed to germinate after treatment with kinetin.—E.B.O.

1432 van Dobben, W. H. De gevoeligheid van wintergerst ten aanzien van de zuurgraad van de grond. **The susceptibility of winter barley to soil acidity.** *Jaarb. Inst. biol. scheik. Onderz.* 1957, 65–8, bibl. 3, English summary and table heads.

Winter barley (variety Vinesco), winter rye (Petkus), and a mixture of the two were grown in 1956 on each plot of an old experimental field. The soil was sandy, and various pH values had been achieved by the constant use of different nitrogenous manures. The number of stems and the grain yields are recorded. Whereas rye reacts only slightly when the pH value increases from 4 to 5·5, barley shows much better tillering, competitive vigour and grain yield. The optimum does not seem to have been reached with a pH value of 5·5. Even at this value winter barley is no match for rye when grown in a mixture. F.s.—G.M.R.

1433 British Farmer. **Nitrogen content of barley.** *Brit. Fmr* 1958, N.S. No. 14, 31–2, illus.

[See also Abs. 954.]

1434 Fröier, K. Åtgärder för att höja maltkornskvaliteten. **Ways of improving the quality of Swedish malting barley.** *Sverig. Utsädesfören. Tidskr.* 1957, **67,** No. 4/5, 271–91, English summary.

Past and present views on the requirements for malting quality in barley in Sweden are reviewed and discussed. They include : (a) the extract should be at least 80%, (b) protein contents should be low (9·5 – 10·5% for a good sample), (c) germinating energy (germination after 5 days) should be over 92%, (d) kernels should be uniform in size, of good colour, well filled and without damage from threshing, storage, or drying. Procedures for assessing malting quality in barley are outlined, together with an account of international work on quality in malting barley, sponsored by the European Brewery Convention. Progress in breeding new malting barley varieties is reviewed, with notes on a number of varieties, including

Selecta, Heimdal, Balder, Ingrid, Carlsberg, Domen, Proctor and Sv50/102. Suitable districts for growing malting barley in Sweden are discussed, together with cultivation techniques designed to ensure good malting quality.—P.J.B.

1435 Nuttonson, M. Y. **Barley-climate relationships and the use of phenology in ascertaining the thermal and photo-thermal requirements of barley. Based on data of North America and of some thermally analogous areas of North America in the Soviet Union, Finland, Poland and Czechoslovakia.** *Amer. Inst. Crop Ecology* 1957, pp. 280, bibl. 119, 7 maps.

In predicting the maturity of winter barley, day-degrees above 40°F. could be computed from 1 March, and for spring barley from the date of sowing or emergence. The product of day-degrees and average hours of daylight required for the maturity of Olli spring barley was found to be more uniform over a wide range of latitudes, elevation and climate than the numerical expression of day-degree requirements of the same barley variety over a similar range of environmental conditions. This was not so in the case of the variety Trebi, which did not appear to be photosensitive. [See also *Fld Crop Abstr.* 10 : 406.]—R.B.

1436 Musaeva, L. D. [**Effect of water deficiency on respiration of barley at different periods of development.**] [Russian] *Fiziol. Rast.* (*Pl. Physiol., USSR*) 1957, **4**, No. 3, 234–42, bibl. 16, English summary. [Hertsen Pedagogic. Inst., Leningrad]

1437 Widdowson, F. V. and Cooke, G. W. **Nitrogen fertilizers for spring barley and wheat.** *J. agric. Sci.* 1958, **50**, No. 3, 312–21, bibl. 2, illus. [Chem. Dep., Rothamsted Exp. Sta., Harpenden, Herts]

Ten experiments on spring barley (mainly Proctor) and 4 on spring wheat (mainly Atle) in 1954–6 compared the effects of 0·25 and 0·5 cwt. N (as ammonium sulphate)/ac. when drilled with the seed, with dressings broadcast before sowing. Top-dressings of nitro-chalk (0·25 and 0·5 cwt. N/ac.) applied in mid-May were also tested. For barley, combine-drilling gave higher yields than broadcasting the same N dressing on the seedbed. For wheat, combine-drilling increased yields only at high levels of N treatment. For both crops, 0·5 cwt. N/ac. drilled with the seed was almost sufficient for maximum yields, but where only 0·25 cwt. N was applied at sowing, a mid-May top-dressing of 0·5 cwt. N/ac. increased yields. At most centres, May top-dressings of nitro-chalk gave lower yields than equivalent ammonium sulphate drilled with the seed. Lodging often reduced yields on plots which received seedbed dressings + top-dressing or the heavier rates of top-dressing alone ; these treatments also reduced grain-quality. None of the seedbed dressings caused serious lodging or reduced grain-quality. The % N was hardly affected by seedbed treatments, but was increased by equivalent top-dressings in May. Seedbed dressings + top-dressings supplying heavier total quantities of N continued to increase N% in grain, without giving any increase in yield. On average, recovery of N from dressings of 0·5 cwt./ac. was about one-third in barley and one-eighth in wheat. F.s.—A.M.H.

1438 Société d'Encouragement de la Culture des Orges de Brasserie et des Houblons en France. Rapports sur la campagne 1955. [**Report for the season 1955.**] [n.d.], pp. 82. [Received March, 1958]

1. Winter-barley trials, pp. 13–15. The variety Dea yielded more than Bordia with over 5000 kg./ha., but its grain is smaller than that of Bordia and has a low protein content.
2. Spring-barley trials at Maule, pp. 16–33. Of 13 varieties tested, the 9 best yielded 4000–4283 kg./ha., none being better than the control Aurore. In a trial with Aurore, the highest yield was obtained from a seed rate giving 200 plants per sq. m. and from applying 40 kg. N/ha.
3. In trials at Grignon with the barley varieties Aurore, Busser and Rika, the application of 30 kg. N/ha. was adequate ; higher amounts of N were detrimental to quality, pp. 34–6.
4. In the regional trials, the barley variety Beka was best (81% extract and 10·3% protein on a dry-matter basis), pp. 37–8.
5. Barley quality in France in 1955, pp. 39–42. Of the varieties mostly grown, Isaria was best, closely followed by Busser.—E.B.O.

MAIZE

See also Abs. 1525, 1725, 1737, 1779, 1849, 1850, 1851, 1852, 1856

1439 Becker, W. R. and de Haan, G. H. De verbouw van maïs. [**Maize-growing.**] *Rep. Exp. Fm "De Bouwing", Randwijk* [n.d.], 70–3. [Received 1958]

On the river-clay soil of De Bouwing Experiment Farm the hybrid maize Wisconsin 240 gave, in 1953, a dry-grain yield of 5400 kg. per ha., which exceeds the average for the inter-provincial trials on river clay of 4650 kg. and equals the average for all the interprovincial trials in the Netherlands. The variety Goudster, sown in 1954 under different conditions of tillage, yielded 3260 kg. per ha. (the Netherlands' average for this variety is 4030 kg. per ha.). The 2 years' trials showed that maize can be a successful crop on the Experiment Farm ; that sowing should be done in the last week of April ; that weed control can be effected by the use of DNC (for " summer weeds")

and 2,4-D (for "root weeds"), both applied as spray from before, to just after, emergence and until the crop is 10–15 cm. high; and that the harvesting technique must be expert. Early development was somewhat better when the maize was sown in flat ridges rather than on level ground.—G.M.R.

1440 Brandolini, A. I mais ibridi in Italia. [**Hybrid maize in Italy.**] *Publ. 89 Sta. Sper. Maiscolt. Bergamo* 1957, pp. 16, illus.

1441 Morel, G. Le maïs en Doukkala. [**Maize in Doukkala (Morocco).**] *Terre maroc.* 1958, **32**, No. 342, 175–7.

1442 Brown, P. **Maize cultivation trials 1947-1957.** *Nyasald Fmr For.* 1958, **4**, No. 2, 13–17.

In 7 trials, yields of maize sown in late December-January were 19–62%, and those sown during the first 3 weeks of December were 61–90% of those from crops sown in November-early December. Yields were not significantly affected by preparing the ground in June or October, or after the first rains. Cultivation trials showed a slight benefit from splitting the ridges, as against remaking old ridges, and a slight further advantage from deep-digging the furrow beforehand. There were no marked differences in yields from ridged and flat land, except in a very dry year, when ridging and boxing increased yields. Light mulching (stover from an equal area of maize laid in the furrows) increased yields by an average of 27% and heavy mulching (6-in. layer) by an average of 52%.—A.M.H.

1443 Lappo, A. I. and Sokolov, V. S. **The depth of inter-row cultivation of maize fields in the non-chernozem zone.** [Russian] *Vestn. sel'skohoz. Nauki* (*J. agric. Sci. USSR*) 1958, **3**, No. 4, 45–8, English and German summaries.

Studies at the White Russian Scientific Research Institute for Agriculture during 1955–7 have shown that when maize is sown (square-pocket method) on sandy or heavy loams, the first inter-row cultivation should be done (when the plants have from 3 to 5 leaves each and the main mass of roots is near to the stem) to a depth of 10–12 cm. The depth of each subsequent cultivation must be gradually reduced and the last should not exceed 4–6 cm. F. Eng. s.—M.H.

1444 Willis, W. O. **Soil temperature, mulches, and corn growth.** *Iowa State Coll. J. Sci.* 1957, **31**, No. 3. [Received May, 1958]

In field and glasshouse experiments in Iowa, the presence of straw mulches or a polyethylene film on the soil surface, increased the time from tasseling to silking by 2–4 days. In experiments in which maize was grown on heated soil, growth rates increased linearly by a factor of 2·8 for every increase of 10°F. in soil temperature in the range 60–80°F. The best soil temperature for plant growth at a depth of 4 in. was 75°F.—P.J.B.

1445† Ryan, F. E. **Maize for fodder or grain.** *J. Dep. Agric. W. Aust.* 1958, **7**, No. 2, 169–71, illus.

Recommendations are made concerning seed-bed preparation, sowing-time, seed rate and spacing, manuring and harvesting under Western Australian conditions. Hickory King is recommended for green feed and Dawn, Emblem and DS28 for grain. Suitable spacings for grain crops are drills 3 ft. apart with 12 in. between seeds under moist conditions or drills 4 ft. apart with seeds 16 in. apart under drier conditions. Broadcast sowing or close drilling is more suitable for fodder crops.—A.M.H.

1446 West African Maize Research Unit. **1956 Trials.** Ibadan, 1958, pp. 35. [Received June, 1958]

The results of maize variety-, acquisition-, and hybrid-trials carried out in Ghana and Nigeria are tabulated. Except for one trial at Asuansi, Ghana, trials of selected varieties all gave low yields. This was attributed to unusually low rainfall. WAMRU 3 and 6 were least influenced by severe drought in the second season. At Kwadaso and Ibadan, 2 Martinique varieties outyielded local ones. 14 Costa Rica lines outyielded improved local varieties at Umudike and Ibadan. Yields of local varieties varied widely, but 5 yielded more than the improved local variety, Lagos White. In a spacing trial at Ibadan yields of the local variety and of WAMRU 3 were higher at 17,000 plants/ac. than at 9500/ac. Yield of the local variety was more depressed by low population density than that of WAMRU 3.—A.M.H.

1447 Mascarenhas, G. H. N. Experimentação de milhos nos Açores em 1956. [**Maize trials in the Azores in 1956.**] *Bol. Com. reg. Cer. Açores* 1957, **12**, No. 26, 115–30, English and French summaries.

Tabulated results are given from maize trials to study plant density, manuring and adaptation of hybrids. Indiana 909, US 13, U 67 and U 72, especially the first, showed good adaptation. [See also Abs. 7.]—E.B.O.

1448 Wurgler, W. Désherbage des champs de maïs. [**Weed control in maize fields.**] *Rev. rom. Agric.* 1958, **14**, No. 5, 37–9, bibl. 7, illus. [Sta. féd. Essais agric., Lausanne]

Suitable cultural measures and repeated hoeing are generally adequate for controlling weed growth in maize, but when it is necessary to resort to chemical means the use of dinitro-ortho-cresol products should be avoided, and 2,4-D products

should be employed only where there is infestation by deep-rooting plants. In applying 2,4-D products, the spray bar must be so adjusted as to prevent the liquid flowing into the cornet-shaped young maize leaves. Good results have been obtained from the use of simazin which may be applied, just after the maize has come up, in doses ranging from 3 to 10 kg. per ha. For the control of *Agropyron repens* the heaviest dose should be used, and in this case it is advisable to sow maize again the following year, because simazin remains for a long time in the soil when applied heavily and can be injurious to other crop plants.—G.M.R.

1449† Bordeleau, R. and Coiteux, F. Les herbicides en pré-émergence dans la culture du maïs. [**Pre-emergence herbicides in maize culture.**] *Rep. Quebec Soc. Protect. Pl.* 1956, **38**, 69–75. [Federal Exp. Sta., L'Assomption, P.Q.]

The action of 7 selective herbicides, applied before emergence, for controlling weeds in maize crops grown for silage was investigated. Sinox PE at 4·5 lb. a.e./ac. controlled *Echinochloa crus-galli*, *Polygonum convolvulus*, *P. persicaria* and species of *Oxalis*, *Brassica*, *Ambrosia* and *Chenopodium*, but not *Agropyron repens* or *Taraxacum officinale*. CMU at 1 lb. of 80% active ingredient/ac. appeared to reduce maize yields a little, and there were some plants of *P. persicaria*, *A. repens* and *Chenopodium* spp. remaining after treatment. 2,4-D at 1·5 lb. a.e./ac. applied before emergence controlled some of the weeds on which it has no post-emergence effect, but it was not so efficacious as Sinox PE and had no effect on *A. repens*. Endothal at 10 and 12 lb./ac. and 25% propham at 4 and 6 lb./ac. did not provide satisfactory control. Treatments of dalapon, dalapon + CMU, TCA + CMU, TCA + endothal, and CMU + endothal injured the crop. 2,4-D and Sinox PE applied to other fields containing sedges, *Cirsium arvense* and species of *Brassica*, *Chenopodium* and *Ambrosia* controlled all weeds present, but only 80% of *Cirsium arvense* was killed by Sinox PE.—R.B.

1450 Swanson, C. L. W. and Jacobson, H. G. M. **Effect of adequate nutrient supply and varying conditions of cultivation, weed control, and moisture supply on soil structure and corn yields.** *Agron. J.* 1957, **49**, No. 11, 571–7, bibl. 10, illus. [Connecticut Agric. Exp. Sta., New Haven]

The necessity for cultivating maize to control weeds was investigated where sufficient plant nutrients and moisture were supplied, and chemical weedkillers were used. For 3 years, during which maize was grown continuously, yields from uncultivated plots equalled those from cultivated plots. F.S.—R.B.

1451 Mitchell, W. C. **Organic phosphate insecticides as seed treatments on corn, soybeans and sorghum.** *Iowa State Coll. J. Sci.* 1957, **31**, No. 3, 480–1. [Received May, 1958]

Chlorthion, diazinon, EPN, malathion, lindane and dieldrin were used, as wettable powders, at rates of 0·5, 1, or 2 oz./bu. to treat maize, soyabean and sorghum seed for control of the wireworm *Melanotus communis*. Dieldrin gave the best results in terms of stand counts, green weights of plants and radicle and plumule lengths, even after treated seed was stored for 13 months. Diazinon, EPN, lindane and dieldrin gave the best wireworm control in glasshouse tests, but did not differ significantly among themselves in this respect. The results are given of studies on correlations between field stands and total seed germination in the laboratory.—P.J.B.

1452 Hemberg, T. **Auxins and growth-inhibiting substances in maize kernels.** *Physiol. Plant.* 1958, **11**, No. 2, 284–311, bibl. 39. [Bot. Dep., Roy. Pharmaceutical Inst., Stockholm]

1453 Dobrynin, G. M. [**Roots of *Zea mays* and some of their biological features.**] [Russian] *Doklady Acad. Nauk SSSR* (*Proc. Acad. Sci. USSR*) 1958, **119**, No. 4, 819–22, illus. [Leningrad Agric. Inst.]

1454 Kumazawa, M. **Vascular connection of the axillary shoot and the adventitious root with their mother axis. Vascular anatomy in maize. 6.** [Japanese] *Bot. Mag. Tokyo* 1958, **71**, No. 836, 70–6, bibl. 13, illus., English summary. [Nagoya Univ. Japan]

1455 Ermilov, G. B. [**The physiology of plant flowering.**] [Russian] *Doklady Akad. Nauk SSSR* (*Proc. Acad. Sci., USSR*) 1958, **118**, No. 3, 598–600, bibl. 6. [Biol. Inst., Ural'sk Filial Acad. Sci. USSR]

While there has long been interest in the transition of plants to the flowering stage, little attention has hitherto been given to those features of flowering which are affected by seed quality at sowing time ; the seeds, even those from one grass ear, are often uneven in quality. The author has studied the effect in maize of seed ripeness (5 varieties differing in their rate of ripening) on flowering of the plants. The seed was harvested at the phases of milk- and wax-ripeness, one variety being harvested, in addition, at the beginning of milk ripeness. The seed was sown (4 replications) on the square-pocket method, 3 seeds per pocket. The difference between the varieties in time of seedling emergence was not more than 1 or 2 days, and growth during the vegetative period was fairly uniform (between varieties and in each replication). Records were kept of the number of days which

elapsed from the time of full germination to : (a) the beginning of flowering ; and (b) the attainment of 25, 50 and 75% of full flowering in the male and female inflorescences. Plants from wax-ripe seeds were earlier in their reproductive development than those from milk-ripe seeds. For example, with 25% flowering (male inflorescences) the plants from wax-ripe seeds were 4–5 days earlier than those from milk-ripe seeds ; with 50% flowering they were 4–7 days earlier and with 75%, 5–8 days earlier. In the female inflorescences development was earlier by 6–7, 8–9 and 5–12 days for the stages 25, 50 and 75% flowering, respectively. The author attributes differences observed (in the field) in maize flowering times not only to variation in the micro-environment during growth, but also to differences in the degree of ripeness of the seed when sown.—M.H.

1456 Carles, J. and Calmés, J. L'équilibre protidique du limbe des feuilles de maïs. [**The equilibrium of nitrogenous substances in the leaf blade of maize.**] *C. R. Acad. Sci., Paris* 1957, **245**, No. 25, 2356–8, bibl. 2.

The percentage of N (on a dry-matter basis) was determined in the middle and the 2 ends of leaf blades taken at different heights on the plant and at different stages of development, in a maize plant which had been manured with N fertilizer and in one which had not. There was a considerable uniformity in the N content, which was about the same in all the leaf blades of the plant, this being influenced by leaf age and manuring only. The amount of N in leaf blades decreased regularly from 5% in a young plant to 0·6% at harvest.—E.B.O.

1457 Hanway, J. J. and Englehorn, A. J. **Nitrate accumulation in some Iowa crop plants.** *Agron. J.* 1958, **50**, No. 6, 331–4, bibl. 11. [Iowa Agric. Exp. Sta. Ames]

Nitrates accumulate more in the stems and stalks than in the leaves and seedheads of maize, sorghum and soyabeans and normally decrease with maturity. Plant-nitrate contents increase with inadequate moisture availability and also following an increase in soil N availability from fertilizing, manuring or the growing of legumes.—M.H.F.

1458 Homès, J. Effets du rapport potassium-magnésium sur le développement de *Zea mays* L. [**Effects of the K/Mg ratio on the development of *Z. mays*.**] *Ann. Physiol. vég. Univ. Brux.* 1956, **1**, No. 2, 35–54, bibl. 6, illus. [Received June, 1958]

In pot trials with the maize variety Wisconsin 240, the determination of fresh- and dry-weight of whole plants, after 40 days' growth, indicated that the optimal nutrient K/Mg ratio for the development of maize in the vegetative stage is about 0·7.—E.B.O.

1459 Hutchcroft, C. D. **Contamination in seed fields of corn resulting from incomplete detasseling.** *Iowa State Coll. J. Sci.* 1957, **31**, No. 3, 449–50. [Received May, 1957]

An investigation was made of factors involved in pollen dispersal within fields of maize grown for seed, in relation to current seed certification standards in the USA. The factors included : silking date, distance from the source of contamination, length of tassel in relation to the percentage of contamination and the reliability of estimates of the amount of contamination, as measured by pollen collection on slides.—P.J.B.

1460 Prummel, J. Rijenbemesting met fosfaat bij peulvruchten en maïs. [**Band placement of phosphate in legume and maize crops.**] *Landb Voorl.* 1958, **15**, No. 2, 83–91, bibl. 4. [Inst. voor Bodemvruchtbaarheid, Groningen]

Applications of 0, 30, 70, 120, and 200 kg./ha. of P_2O_5 were made to Goudster maize grown in sandy soil. The methods of application were (a) a single band above the seed, (b) a single band below the seed, (c) 2 bands one on each side of the seed row, (d) broadcast. Band placement of fertilizer gave noticeably better yields, even at 200 kg./ha. ; it was about 4 times as effective as when fertilizer was broadcast. The crop flowered and ripened earlier when it was banded with fertilizer.—R.B.

1461 Lanza, F. La nutrizione minerale del mais. Panorama bibliografico e primo contributo sperimentale. [**The mineral nutrition of maize. Bibliographical review and first experimental contribution.**] *Publ. 90 Sta. Sper. Maiscolt. Bergamo* 1957, pp. 45, bibl. 120, French summary.

The results from one-year plot-trials in Bergamo Province, Italy, in 1956, indicated that, with about 600 mm. of rain during the vegetative cycle of maize, in a soil having a total P_2O_5 of about 1·35 per 1000 parts (of which about 5 mg./kg. are assimilable) and a total K_2O of about 1·5 per 1000 parts (of which 0·07 mg./kg. is exchangeable), the yield of a hybrid maize of the Wisconsin 641 AA type is dependent on the amount of N applied, irrespective of the type of N fertilizer used and the date of its application. In these trials the dry-grain yield varied from 4600 kg./ha. with no N applied to 7200 kg./ha. with the application of 100 kg. of N per ha.—E.B.O.

1462 Salmond, K. F. **Investigations into grain storage problems in Nyasaland with special reference to maize (*Zea mays* L.).** *Colon. Res. Publ. 22, Colon. Office, London* 1957, pp. 49, bibl. 39, illus. [Dep. Agric., Zomba, Nyasaland] [Received April, 1958]

The range and economic importance of insects associated with bulk-stored maize in Nyasaland was assessed. The most important insect pests

were *Calandra oryzae* (rice weevil) and *Sitotroga cerealella* (a Gelechiid moth). Surveys showed that mean insect damage (% grains damaged) in maize stored at the African produce markets was 4% and in the villages 7·5%. Weight losses in untreated, bagged maize were 5% after 8–9 months' storage and 17·6% after 18 months. During a normal storage season there may be a gain or a loss of 4% moisture content. Satisfactory results were obtained from an underground storage trial. Fumigation with methyl bromide gave better protection than contact insecticides, but reinfestation by *Tribolium* spp. and *Ephestia cautella* occurred. Recommendations include : breeding to select well-covered cobs and hard grain ; education of Africans in storage hygiene ; the use of wood ash sprinkled among cobs to hinder spread of infestation ; methyl bromide fumigation for all stocks stored by the Produce Marketing Board ; routine monthly spraying of fumigated stocks with 25% lindane (or lindane + DDT) ; development of underground storage for long-term famine reserves. F.S.—A.M.H.

1463 Kockum, S. **Control of insects attacking maize on the cob in crib stores.** *E. Afr. agric. J.* 1958, **23,** No. 4, 275–9, bibl. 3. [Dep. Maize and Produce Control, Kenya]

In an experiment carried out in 1952 good control of insects causing crib-storage losses of maize was obtained by dusting cobs with 0·4% γ BHC in a local diatomite powder at 8 oz./9 cu. ft. of cobs. Analysis of the results showed that 0·5% γ BHC at the same rate (equivalent to 12·5 ppm.) should give complete control for 6 months. The insecticide was almost entirely removed during shelling. Dusting exposed cobs with pyrethrum powder did not reduce insect damage. Crib walls made from wire-netting, Napier grass, grass thatch and hessian cloth did not differ in the protection they gave against insect damage. Virtually complete protection for 13 months was given by dusting cobs with 0·06% γ BHC at 8 oz./9 cu.ft. (1·5 ppm.) and surrounding the crib with a wall of hessian cloth treated with 40 g. γ BHC and 4 g. coumarone resin in 1 l. kerosene/100 sq. ft. of hessian.—A.M.H.

1464 Teter, N. C. and Roane, C. W. **Molds impose limitations in grain drying.** *Agric. Engng, St. Joseph, Mich.* 1958, **39,** No. 1, 24–7, bibl. 11. [Tidewater Res. Sta., Holland, Virginia]

A time-temperature limitation curve is given for drying shelled maize to 15·5% moisture content at a speed sufficient to prevent the growth of moulds. F.S.—R.B.

1465 Caputa, J. Étude de la conservation des épis de maïs hybride pour semences en séchoir à claire-voie " crib." [**Storage of the ears of hybrid maize for seed by drying in open-work cribs.**] *Landw. Jahrb. Schweiz* 1957, **71,** No. 7, 775–83, German, English and Italian summaries. [Stations Fédérales d'Essais Agricoles, Lausanne]

The course of the drying of hybrid maize cobs during the winter following harvest, the germination power of the maize seed during this period, and the influence of threshing on the germinating power of the seed in relation to its moisture content were studied. F.S.—D.B.

1466 Genter, C. F. **Plot competition between corn hybrids.** *Agron. J.* 1958, **50,** No. 4, 205–6, bibl. 1. [Virginia Agric. Exp. Sta., Blacksburg]

In trials during 1953 and '54 in Virginia, two maize hybrids, Ohio C54 (early) and US578 (late), representing the extremes of maturity classes in their region of adaptation, were used to study plot competition effects. Each hybrid was grown in plots as follows : (a) between 2 plots of Ohio C54, (b) between 2 plots of US578, and (c) between plots of Ohio C54 on one side and US578 on the other. Single- and double-row plots were used. Rows were spaced 3 ft. apart and plant populations were approx. 15,000/ac. Combining yield data for both years and for both single- and double-rowed plots showed significant yield differences in both hybrids as a result of border competition. The mean grain yields of all plots bordered by Ohio C54 were 5·9% higher than those bordered by US578. Ohio C54 gave 4·6% lower yields when bordered by US578 than when bordered by itself, while US578 gave 7% higher yields when bordered by Ohio C54 than where bordered by itself. Yields of Ohio C54 between mixed borders approached those where it was grown between US578, while yields of US578 grown between mixed borders approached those where it was grown between Ohio C54 and were significantly higher than where grown between two borders of the late hybrid. There were no consistent or significant differences between 1-row and 2-row plots in their border effect. It was thought advisable to keep maize hybrids of similar maturity classes together in plot experiments.—P.J.B.

MILLETS AND SORGHUMS

See also Abs. 1451, 1524, 1809, 1850, 1852, 1853

1467 Tourté, R. and Fauché, J. Recherches pluriannuelles sur les densités de semis et les écartements des mils (*Pennisetum*) et sorghos. [**Several years' investigations on sowing density and spacing of millets (*Pennisetum*) and sorghum.**] *Bull. agron. Fr. d'out. mer* 1957, No. 15, 58–66, bibl. 5, illus. [Cent. Rech. Agron., Bambey, Senegal]

The experiments described were carried out in 1953–5. The millet, Sanio 165, was sown in

single drills, 1, 1·5 and 2 m. apart, and also in twin drills, 40 cm. apart, with 1·5, 2 and 3 m. distance between their axes [line running down the centre of the twin drills]. Various down-the-row spacings were used giving a density of 10, 20 and 40 thousand pockets per ha. for each distance between single drills, or twin drills tested. The optimal density was 10,000 pockets per ha. obtained by drilling with a distance of 1·5 m. between single drills or 2 m. between the axes of twin drills. The sorghum, variety Congossane, was similarly sown, and optimal technique in this case was found to be the use of single drills, with a distance of 1·5 or 2 m. between them, and a sowing density of 40,000 pockets per ha. Some preliminary experiments in mechanized cultivation are described, and plants suitable for intercropping are discussed.—G.M.R.

1468 Bono, M. and Fauché, J. Nouveaux résultats dans l'étude de l'action de quelques engrais minéraux sur les sorghos et les mils. [**Recent results of research on the effect of some mineral fertilizers on sorghums and millets.**] *Bull. agron. Fr. d'out. mer* 1957, No. 15, 100–10, bibl. 5. [Cent. Rech. Agron., Bambey, Senegal]

Different mixtures of NPK were studied (1953–5) for their effect upon the sorghum variety Congossane and the millet (*Pennisetum* sp.) variety Sanio 165, with special reference to the number (per unit area) of pockets at harvest, the mean number of panicles or ears harvested per pocket, the mean weight of grain, panicle or ear on threshing, and the length of the growing period.—G.M.R.

1469 Bono, M. and others. Contribution à l'étude des populations sélectionnées de mil (*Pennisetum typhoides*). [**Contribution to the study of selected populations of bulrush millet (*Pennisetum typhoideum*).**] *Bull. agron. Fr. d'out. mer* 1957, No. 15, 49–57, bibl. 5. [Cent. Rech. Agron., Bambey, Senegal]

The plant populations of 4 selection plots of bulrush millet were studied for the relationships which exist between the different characters observed (22 in number), and especially for the relationships between these characters and the production of grain per plant.—G.M.R.

1470 Klinck, H. R. and Gervais, P. Le millet—une récolte céréalière de secours pour le Québec. [**Millet, an emergency cereal crop for Quebec.**] *Agriculture, Montréal* 1957, **14**, No. 6, 173–5, bibl. 5.

Experiments were carried out at Macdonald College and Lennoxville over a 5-yr. period to compare the yields of proso millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) with those of barley and oats, when these crops were sown in early- and mid-June. Yields of millets from the earlier sowings were inferior to those of barley and oats in both districts. Yields of foxtail millet from later sowings in the Macdonald College area were no better than those of barley or oats, while yields of proso millets were greater than barley yields but less than oat yields. Yields of foxtail millet from later sowings at Lennoxville were the greatest of any cereal crop in 4 out of 5 years, average yields also being greater than yields of other cereals ; proso millet gave higher yields than barley or oats in some seasons. In eastern Quebec, millet appears to be a useful emergency crop, but only when sown in the last fortnight of June.—R.B.

1471† Nanda, K. K. **Effect of photoperiod on stem elongation and lateral bud development in *Panicum miliaceum* and its correlation with flowering.** *Phyton* 1958, **10**, No. 1, 7–16, bibl. 18, Spanish summary. [Dep. Bot., Univ. Delhi, India]

Plants of *Panicum miliaceum* var. p.v. 36 were grown in pots under short-day, normal-day and long-day treatment. Stem elongation, flowering, tillering and branching of plants were recorded. Flowering took place only in short-day and normal-day plants. The initiation of branches in long-day plants took place in acropetal succession and they continued to grow vegetatively without showing any floral initiation. In short-day and normal-day plants, initiation of branches took place only after the emergence of the ear of the main shoot, and occurred in basipetal succession. The flowering of these branches was also basipetal and earing occurred within a few days after their emergence so that very little vegetative growth was produced. The emergence of secondary branches and their flowering behaviour under these photoperiodic treatments followed the same pattern as the primary branches. Stem elongation was very much accelerated in short-day and normal-day plants, while the increase in height was very slow and gradual in long-day plants. It is considered that the differences in the mode of branching and stem elongation under different photoperiods are a result of alterations caused by these treatments in their flowering behaviour. These results are discussed. F.S.—E.B.O.

1472 Tu, Č. M. [**An experiment on the method of sowing *Setaria italica* in the winter solstice. First communication.**] [Chinese] *Acta agric. sinica* 1957, **8**, No. 3, 261–75, bibl. 57, illus., Russian summary.

1473 Miyaji, Y. and Kokubu, T. **Studies on the photoperiodic response in *Setaria italica*. 3. On the flower formation under long day condition and the reversal of the growth phase resulting from short term treatment with short day in a late variety of Italian millet.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1957, **26**, No. 2, 148–9, English summary.

In an extremely late variety of Italian millet, flowers were formed under a 15-hr. day. The reversal of the growth phase was most marked when plants were kept under a 15-hr. day after an 8-hr. photoperiod treatment for 12 days. F.Eng.s. —D.B.

1474 Brown, P. L. **Interrelations of soil and crop management practices in grain sorghum production.** *Iowa State Coll. J. Sci.* 1957, **31**, No. 3, 368–9. [Received May, 1958]

Studies were made during 1954–5 of interactions between plant population, spacing between rows, and available soil moisture at sowing time on the grain yields of sorghum, grown in Kansas on well-drained silt loam. Plant populations ranged from 15 to 120 thousand/ac., spacings between rows were 10, 20, or 40 in. and 3 levels of soil moisture were obtained by wetting the soil to field capacity to depths of 3, 5, or 7 ft. to give *c.* 6, 10·5 and 14·5 in. available soil moisture at sowing time, respectively. The results indicated that where the soil was moist to depths of less than 3 ft., 3–5 ft. and 5–7 ft., optimum plant populations were less than 30 thousand, 30–60 thousand and 60–90 thousand, respectively.—P.J.B.

1475 Leukel, R. W. and Webster, O. J. **Sorghum seed-treatment tests in 1957.** *Pl. Dis. Reptr* 1957, **41**, No. 12, 992–3. [Nebraska Agric. Exp. Sta., Lincoln]

Samples of Rancher and Combine-60 sorghum grain infested with covered kernel smut, *Sphacelotheca sorghi*, were treated with 11 mercurial and 11 non-mercurial seed disinfectants at 0·75 and 1·5 oz./bu. respectively. Seed was sown at Beltsville and Lincoln at the end of May and the beginning of June. Untreated Combine-60 showed 32% infestation at Beltsville, and crops from seed treated with arasan 75, orthocide, phygon, spergon, and 7 mercurial compounds were completely free from infection. At Lincoln, untreated Combine-60 showed 11% infection ; complete control was achieved with the panoram 75, orthocide, spergon, vancide, agrox, ceresan M, puraseed and setrete treatments. Untreated Rancher showed 30% infestation at Beltsville and 11% at Lincoln. In both localities, complete control of smut on Rancher was achieved with phygon, ceresan M and panogen. At Lincoln, spergon and 5 mercurial compounds also completely controlled the fungus. —R.B.

1476 Wiese, A. F. and Rea, H. E. **Treating irrigated sorghum with 2,4-D.** *Agron. J.* 1958, **50**, No. 6, 309–10, bibl. 10., illus. [Texas Agric. Exp. Sta. and West. Soil and Water Man. Br., U.S.D.A.]

2,4-D amine and ester formulations were applied to Redbine 60 and 66 sorghums at different vegetative stages. The most serious reductions in grain yields occurred when the herbicide was applied at flowering time and many florets failed to set seed. Applications to young plants delayed flowering and inhibited root development in one out of three years. Applications at 0·5 lb. per ac. did not reduce yields, unless applied at flowering, but 1 or 2 lb. per ac., after irrigation, tended to reduce yields.—M.H.F.

RICE

See also Abs. 1524, 1850, 1853

1477 Nagy, V. Risicoltura in Ungheria. [**Rice-growing in Hungary.**] *Riso* 1958, **7**, No. 4, 12–17, illus.

1478 Patrucco, G. Risicoltura in Cile. [**Rice-growing in Chile.**] *Riso* 1958, **7**, No. 5, 9–11, illus.

1479 Patrucco, G. La risicoltura uruguayana. [**Rice-growing in Uruguay.**] *Riso* 1958, **7**, No. 3, 6–8, illus.

1480 Castle, P. S. **Rice cultivation in Buem.** *Ghana Fmr* 1958, **2**, No. 1, 25–7, illus.

An account is given of rice-growing in the Buem district of Togoland, Ghana. Red rice varieties, maturing in about 18 weeks, are grown on the hillsides and white-grained varieties, which ripen in about 14 weeks, in the valley bottoms.—C.L.S.

1481 Dadey, C. A. **Rice extension scheme in the Dagomba district, Northern Ghana.** *Ghana Fmr* 1958, **2**, No. 1, 27–9.

The rice extension scheme operated in Dagomba by the Department of Agriculture is described. Broad, level valley bottoms are cleared and stumped by the villagers and disc-ploughing, disc-harrowing or rotovating is carried out by the Department. The varieties Guiana 79, D99 and Lal 22 are grown.—C.L.S.

1482 Seko, H. and others. **Interrelation between the ecological characters of rice varieties and the duration of nursery period in late period cultivation of paddy rice.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1957, No. 4, 16–29, bibl. 24, English summary.

In the warmer districts of Japan rice is cultivated after other cash crops, and the late transplanting, in July or August instead of June, results in low yields. These are caused by premature heading or delayed heading according to the response of the variety to temperature, length of day, duration of nursery period and date of transplanting. A table indicates the best nursery period for each of 14 varieties when transplanted on 26 July and 5 Aug. F. Eng. s.—D.B.

1483 Hoshino, T. and others. **Studies on methods of rice-culture in the north temperate region. 1. On the spacing in rice-planting, with special reference to the rela-**

tion between the distance of hills and plant numbers per hill. [Japanese] *Res. Bull. Hokkaido Nat. Agric. Exp. Sta.* 1957, No. 72, 28–35, bibl. 5, English summary.

Better results, as expressed by number of ears, average number of spikelets per ear, percentage fertility, and weight of individual grains, were obtained by increasing the number of hills than by increasing the number of plants per hill. F.Eng.s. —D.B.

1484 Seko, H. and Kuki, M. **Studies on the effects of inter-cultivation in paddy fields. 1. On the plant growth and yield of paddy rice affected by intercultivation.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 31–55, bibl. 3, illus., English summary.

1485 Seko, H. and others. **On the effects of earthing-up upon rice plant.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1957, No. 5, 104–13, bibl. 25, illus., English summary.

The experiments were conducted on transplanted rice. Earthing-up brought about a reduction in the water content and NH_4-N content of the soil, less tillering and an increase in root development, plant height, culm length, panicle length and general luxuriance of growth, but, on good soils, there was no improvement in yield. Yield increases were, however, obtained on poor soils. On "akiochi" fields the evolution of H_2S gas almost ceased after earthing-up of rice plants. Earthing-up was often followed by neck rot. F. Eng. s.—D.B.

1486 Basak, M. N. **Effect of rainfall on the yield of rice and evaluation of water requirement.** *Proc. Nat. Inst. Sci. India (B)*, 1957, **23**, Nos. 1 and 2, 17–34, bibl. 25. [Dep. Agric. W. Bengal, Calcutta]

The water requirement of rain-fed rice from transplanting to maturity was evaluated by comparing, over several years, the yields obtained under different quantities and patterns of rainfall. The highest grain yields were obtained from a total rainfall of 30 in./ac. distributed as follows (in inches) : Aug. (transplanting) 7·7, Sept. 11·1, Oct. (flowering) 9·3, Nov. 1·9, Dec. (harvesting) 0·1. The ideal levels of soil moisture for maximum grain yields were : (in inches of standing water) Aug., 1–2 ; Sept., 2–3 ; Oct., 3–4 ; and (in % saturation) Nov., 100 ; Dec., 50. With the addition of water required prior to transplanting the 30-day-old seedlings, the total water requirement of the rain-fed rice crop in this area is 45·5 in./ac. —D.B.

1487 Bulanadi, J. and Aldaba, P. B. **Effects of water depth on the growth and yield of lowland rice.** *Internat. Rice Comm. News Lett.* 1958, **7**, No. 1, 7–10, bibl. 3. [Bur. Pl. Industr., Manila, The Philippines]

In a trial carried out in 3 localities in the Philippines with 4 rice varieties, Apostol, Macan, Raminad 3 and Wagwag, intermittent irrigation (15 days' irrigation followed by 5 days' drainage) was compared with continuous flow at 5 different levels, with a view to determining an economical and efficient method for using water. Results indicated that the 4 varieties gave higher yields under intermittent irrigation than under continuous flow, although the differences were not statistically significant.—E.B.O.

1488 Chow, L. **Rotational irrigation for rice—a revolution in Taiwan.** *Internat. Rice Comm. News Lett.* 1958, **7**, No. 1, 1–7, bibl. 2. [Joint Comm. Rur. Reconstr., Taiwan]

In Taiwan 2 crops of rice are grown per year wherever there is sufficient water for irrigation. The conventional method for irrigating rice by continuous flow has been replaced almost throughout the island by an intermittent method (4 to 7 day-intervals) by which 20–30% of water can be saved without reducing yields. Information is given on this method, including the difficulties and problems encountered in its application.—E.B.O.

1489 Kesava Iyengar, N. and others. **A note on the effect of cultivating cotton in rice fallows on the yield of succeeding paddy crop.** *Madras agric. J.* 1958, **45**, No. 2, 61–6, bibl. 1.

At 3 centres, Aduthurai, Palur and Coimbatore, representing, respectively, deltaic, coastal and inland areas of Madras State, rice was grown after (a) fallow, (b) cotton and (c) a legume (*Sesbania*). The mean grain yield of rice from all centres under treatments (a), (b) and (c) were, respectively, 3014, 3139 and 3228 lb./ac. The yields at each centre followed this same trend and were highest in the delta and lowest in the inland area. It is concluded that cotton grown as an off-season crop before rice will not depress the rice yield, provided that the rice receives normal manurial treatment. The cotton residue augments the supply of organic matter to the soil. [See also Abs. 278.]—D.B.

1490† Sawamura, T. **A study on the cropping system of the paddy field in Japan.** [Japanese] *Bull. Nat. Inst. Agric. Sci., Nishigahara, Ser. H* 1957, No. 20, 1–194.

The problems and advantages of multiple cropping, with rice, vegetables and fodder plants, are discussed as regards growing season, land use, drainage, irrigation and manuring. F. Eng. s.—D.B.

1491 Arnoux, L. Les principales variétés de riz d'Afrique occidentale française. [**The**

principal rice varieties of French West Africa.] *Riz et Rizicult.* 1958, **4**, No. 1, 41–7, bibl. 3, illus., English and Spanish summaries.

The botanical and cultural characteristics are given of the principal rice varieties grown in French West Africa including 5 varieties selected at the Office du Niger, French Sudan, 4 selected at Richard-Toll, Senegal, and 8 varieties improved at Kankan Station, Upper Guinea.—E.B.O.

1492 MARUYAMA, A. and others. **A new paddy rice variety "Sachiwatari".** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 211–14, illus., English summary.

This variety is more resistant to lodging than are Norin No. 8 and Norin No. 22 ; it is high yielding and ripens later than Norin No. 8. It is recommended for areas where these 2 Norin varieties are subject to leaf blight, leaf spot and "fall down." Sachiwatari is grown in Kanagawa, Wakayama and Kochi Prefectures. F. Eng. s.—D.B.

1493 ADACHI, T. and HAGA, T. **A new paddy rice variety "Bizen-Nishiki." A new paddy rice variety "Homasari."** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 187–90, illus., and 191–4, illus., English summaries.

Compared with Chukyo-Asahi, Bizen-Nishiki ripens later, and is more resistant to bacterial leaf-blight and to lodging. It is suitable for the lower, ill-drained fields. Homasari ripens as early as Norin No. 8, is resistant to fungal diseases but not to "fall down." It is suitable where Norin No. 8 and Minori are unsatisfactory. F. Eng. s.–D.B.

1494 ADACHI, T. and others. **A new paddy rice variety "Hoki-Asahi." A new paddy rice variety "Tsubasa." A new paddy rice variety "Akibae." A new paddy rice variety "Akebono."** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 195–8, illus. ; 199–202, illus ; 203–6, illus. ; and 207–10, illus., English summaries.

Hoki-Asahi is slightly later than Wase-Asahi, gives high yields and is suitable for cool regions, e.g. Tottori Prefecture. Tsubasa is slightly later than Norin No. 8 (one of its parents). It has large panicles, gives high yields, and has greater disease resistance than has Norin No. 8 and Nakate-Asahi. It is grown in the Prefectures of Tottori, Shizuoko, Yamanashi and Osaka. Akibae, bred for mountain regions, is an early variety with long panicles, recommended for Gifu and Fukushima. Akebono was bred for fertile soils. It gives high yields and is resistant to lodging and to several diseases, but not to "fall down". Its grains shed very easily. It is recommended for Mie, Nara, Tokushima, Gifu, Ehime, Asaka and Kagawa Prefectures. F. Eng. s. —D.B.

1495 CIFERRI, R. and PIGNATTI, G. Evoluzione della vegetazione infestante nelle risaie pavesi. [**Evolution of weeds in the rice-fields of Pavia province (Italy).**] *Riso* 1957, **6**, No. 12, 7–10, illus.

Information is given on the plant associations (rice plus weeds) and their evolution during the vegetative cycle of rice. The most important association is the Oryzeto-Cyperetum difformis. Although the total number of weeds decreases during the growing season, *Echinochloa crus-galli* constitutes 10% of the weed flora in July but 50% at harvest (Sept.-Oct.).—E.B.O.

1496 CIFERRI, R. È pericoloso importare in risaia semi di malerbe. [**It is dangerous to import weed seeds into rice-fields.**] *Riso* 1958, **7**, No. 5, 12–14.

Information is given on weed species of rice in various countries, so far absent in Italy but where they could become established.—E.B.O.

1497 OLSEN, K. L. **"Scum" control in rice fields and irrigation canals.** *Rep. Ser. 69 Arkansas Agric. Exp. Sta.* 1957, pp. 20, bibl. 14, illus.

1498 MUNE, T. L. and PARHAM, J. W. **Muraina grass and its control in Fiji.** *Agric. J. Fiji* 1957, **28**, Nos. 3 and 4, 54–5, illus.

Muraina grass (*Ischaemum rugosum*) is a serious annual weed of rice cultivation in Fiji, maturing at the same time as the rice and contaminating the grain. It is of little value as a fodder grass because it rapidly seeds. It may be controlled by ploughing and discing 5 or 6 times during a fallow period from October to May. Muraina seeds may be separated from rice by winnowing or by floating off in water.—A.M.H.

1499 TSUTSUI, K. and others. **Effect and method of application of endrin and dieldrin to control rice stem borer [*Chilo suppressalis*].** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 14–30.

1500 TSUTSUI, K. and others. **Studies on the fluctuation of outbreak of the rice stem borer (*Chilo suppressalis* Walker) and its control on the paddy rice plant transplanted in early period.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 126–41, bibl. 5, illus.

1501 LAVOURA ARROZEIRA. O percevejo do arroz (*Solubea paecila* Dallas). [**Rice stinkbug (*S. paecila*).**] *Lavour. arroz.* 1958, **12**, No. 135, 7.

The method recommended for controlling stinkbug (*S. paecila*) on rice in Brazil is dusting with 1% rhodiatox or rhodiagama 2, at the rate of 15–20 kg./ha.—E.B.O.

1502 Bowling, C. C. **Seed treatment for control of the rice water weevil.** *Rice J.* 1958, **61**, No. 1, 26–9, bibl. 2, illus. [Texas Agric. Exp. Sta., Beaumont]

The effect of treatment of rice seed with insecticides to combat the rice water weevil (*Lissorhoptrus oryzophilus*) was investigated. Field tests showed that aldrin, dieldrin and lindane at 4 and 8 oz. per 100 lb. seed gave more than 90% control of the pest. No significant increase in rice yield was obtained. F.s.—R.B.

1503 Atkins, J. G. and Adair, C. R. **More about hoja blanca.** *Rice J.* 1958, **61**, No. 1, 10–14, bibl. 5, illus.

Tests of varietal resistance to the rice disease *hoja blanca* were carried out in 1957 in Cuba and Venezuela. Many short-grain varieties were resistant, and all long-grain varieties were susceptible. Among the USA varieties tested, Colusa, Asahi, Lacrosse and Missouri R-500 were resistant, and Arkrose was moderately resistant.—R.B.

1504 Ponnamperuma, F. N. **Lime as a remedy for a physiological disease of rice associated with excess iron.** *Internat. Rice Comm. News Lett.* 1958, **7**, No. 1, 10–13, bibl. 3. [Dep. Agric., Paradeniya, Ceylon]

The results from glasshouse and field trials showed that the appearance of "browning" disease of rice on acid, badly drained, lateritic soils in the wet areas of Ceylon, is prevented by liming the soil to a pH of about 6.—E.B.O.

1505 Seko, H. and others. **Effects of foliage sprays of urea on rice plants in "akiochi" or "saline injured" paddy fields.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 56–72, bibl. 20, English summary.

Leaf spraying with urea and $MnCl_2$ on rice plants in "fall down" condition [injured by H_2S] or damaged by sea water improved the condition of the plants, reduced *Helminthosporium* infection and significantly increased yields, provided that the weather favoured ripening. A 2% solution is recommended; it should be sprayed 2–3 weeks before heading to lengthen the panicles and increase the number of grains per panicle and again about 10 days after heading to promote maturity of the grain. Leaf spraying was more effective than soil treatment. F. Eng. s. and text tables.—D.B.

1506 Ting Ying. **The origin and differentiation of cultivated rice in China.** [Chinese] *Acta agric. sinica* 1957, **8**, No. 3, 243–60, bibl. 72, illus., English abstract. [Agric. Coll. S. China]

1507 Brown, F. B. **Natural cross-pollination of rice in Malaya.** *Malay. agric. J.* 1957, **40**, No. 4, 264–8, bibl. 1.

The degree of out-crossing which occurred in the trial described was 0·41%. Ext.—E.B.O.

1508 Ghisleni, P. L. and Eynard, I. Erogazione continua e modulata nel trattamento ultracustico a cariossidi di riso. [**The ultrasonic treatment of rice caryopsides with continuous and modulated emission.**] *Riso* 1958, **7**, No. 4, 9–11, bibl. 5, illus.

In a first trial, the ultrasonic treatment (continuous emission, 15 Watts for 45 min. and 38 W. for 15 min.; modulated emission, 7·5 W. for 45 min. and 19 W. for 15 min.) increased significantly both the germinating capacity and germinating energy of rice seeds of an initial low germinating capacity. In a second trial with rice seeds of high germinating capacity, these same treatments increased the germinating energy only. There was no appreciable difference between treatment with continuous and modulated emission.—E.B.O.

1509 Tang, W. T. and Chiang, S. M. **Studies on the dormancy of rice seed.** [Chinese] *Mem. Coll. Agric. Nat. Taiwan Univ.* 1955, **4**, No. 1, 1–7, bibl. 8, English summary.

Of 587 rice [plants of] varieties from 12 geographical areas, the seed of 30% had no dormant period, 37% germinated within 1–5 days, 16% in 6–10 days, 9% in 11–15 days, and in the remaining 8%, dormancy lasted from 16 to 45 days. Varieties of the *indica* type had a longer range of dormant period (0–45 days) than the *japonica* type (0–30 days). When compared according to geographic origin, the tropical varieties (all *indica* type) from Indo-China, India, the Philippines, Flores, Soembawa and Celebes had a longer dormant period than varieties from northern or temperate countries, e.g. Japan, Korea, Italy and the USA. Varieties having a coloured pericarp had a longer dormant period than those with a colourless pericarp. F. Eng. s.—D.B.

1510 Sircar, S. M. and Chakravorty, Maharani. **Studies on the physiology of rice. 13. Distribution of free auxin in different organs of the plant.** *Proc. Nat. Inst. Sci. India* (*B*) 1957, **23**, Nos. 3 and 4, 102–16, bibl. 22. [Dep. Bot., Univ. Calcutta]

1511 Seko, H. and others. **Studies on the development of various parts of paddy rice plant. 1. Elongation and changes in dry weight of the parts and organs of rice plant and interrelation among them, during the elongation period.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1957, No. 4, 1–15, bibl. 14, illus., English summary.

1512 Fukaki, S. **The investigation on the tillering of rice plant (*Oryza sativa*). 8. Upon the influence of the light-intensity on the tillering of rice plant.** [Japanese] *Tech. Bull. Fac. Agric. Kagawa Univ.* 1957, **8**, No. 2, 240–3, bibl. 6, English summary.

In a good environment [for light intensity] the growth of tillers, assessed by their number and dry weight, exceeded the growth of the main culm. Under a poor environment the converse held. F.Eng.s.—D.B.

1513 Skripčinskiĭ, V. V. **[Natural changes in daylength in the tropics as a factor regulating the rhythm of growth and development of tropical plants.]** [Russian] *Bot. Ž. SSSR* (*Bot. J. USSR*) 1958, **43**, No. 4, 490–503, bibl. 98, English summary.

In this review, the results of experiments with Ceylon varieties of rice (*Oryza*), carried out in the south of India and in Ceylon, have been analysed. It is shown that plant development, leading to the formation of reproductive organs, is regulated by photoperiodic factors, associated with slight fluctuations in daylength. F. Eng. s.—M.H.

1514 Yamada, N. and others. **Studies on ripening of rice. 1. Role of nitrogen in process of ripening of rice.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1957, **26**, No. 2, 111–15, English summary. [Nat. Inst. Agric. Sci. and Saitama Agric. Stat. and Survey Office]

A high N level increased the number of glumes formed and the carbohydrate production, but the rate of increase in the former was greater than in the latter. Therefore, in spite of a higher yield, seed-setting rate and weight of 1000 kernels were reduced because of an insufficient supply of carbohydrates to the individual glumes. Retardation in carbohydrate translocation was not observed. F. Eng. s.—D.B.

1515 Tanaka, A. and others. **Studies on the nutrition of rice plant (*Oryza sativa* L.). 1. Influence of nitrogen level on growth and nutrient uptake by rice plant (*O. sativa* var. *indica*).** *Proc. Indian Acad. Sci.* 1958, **47**, No. 3, 140–54, bibl. 8.

Rice (var. *indica*) plants were grown in water-culture solutions to which N (as ammonium nitrate) was added in doses ranging from 5 to 200 ppm. Maximum yield of grain was obtained at 40 ppm. (corresponding roughly to 30–40 kg./ha. under field conditions). Above this level the yield of grain was depressed. Four plant stages of nitrogen utilization were recorded and are listed. —C.L.S.

1516 Aglibut, A. P. and others. **Measurement of consumptive use of water by lowland rice.** *Philipp. Agriculturist* 1957, **41**, No. 7, 412–21, bibl. 13. [Central Exp. Sta., College, Laguna, Philippines]

During the last 4 months of 1955, stands of the rice variety Milfor 6 (2), grown under flooded conditions in tubs in the open, had an average water uptake of 0·59 cm./day. The water uptake of the variety Tjere Mas, similarly grown, was 0·69 cm./day during September, October and November 1956, and 0·88 cm./day between April and August 1957. The evapotranspiration ratios for Milfor 6 (2) in terms of kg. of water per kg. dry weight were 1941, 1147 and 721 for grain, straw, and grain plus straw respectively. Corresponding transpiration ratios for the same variety were 833, 492 and 309. F.s.—R.B.

1517 Misra, G. and Sahu, G. **Effects of maleic hydrazide on an early variety of rice.** *Curr. Sci.* 1958, **27**, No. 2, 64–5, bibl. 8. [Ravenshaw Coll., Cuttack 3, India]

Seed of the early variety N.136 were soaked for 48 hr. in MH-40 solution (10,000, 1000, 100, 10 ppm.). [When 4 weeks old], seedlings from the previously soaked seed were sprayed twice at weekly intervals with the MH solution corresponding to the one in which they were soaked. The only survivors were those treated at 10, 100 and a few at 1000 ppm. MH-40. In plants which survived 1000 ppm., ear emergence was delayed, but vegetative growth became vigorous later. Compared with controls, an increase in grain yield was observed in plants treated with 10 and 100 ppm. MH ; the lower concentration of MH gave the higher yield and this was a result of its stimulating effect on number of panicles, length of panicles and number of spikelets per panicle.—D.B.

1518 Wahhab, A. and Azim, M. N. **Effect of depth of placement of exchangeable ammonium-nitrogen on rice paddy.** *Agron. J.* 1958, **50**, No. 4, 180–2, bibl. 8. [Agric. Coll., Lyallpur, W. Pakistan]

Exchangeable NH_4-N (as ammoniated clay) was applied at the rate of 60 lb. N/ac. to paddy grown in pots, either on the soil surface or at depths of 2, 4, 6, 9, 15 or 20 in. Significant increases in yield resulted from treatment, fertilization at the 2-in. depth giving the highest yields of grain and total dry matter. Deeper placement induced comparatively more vegetative growth than grain formation. Yields resulting from surface applications were not significantly different from those produced with fertilization at the 2-in. depth. Tillering decreased with increase in depth of fertilizer placement.—R.B.

1519 Garboua, M. Considérations relatives à quelques essais expérimentaux sur la culture du riz au domaine de Malha (Egypte) en 1956. **[Considerations on some trials in growing rice in Malha Province (Egypt) in**

1956.] *Riz et Rizicult.* 1958, **4**, No. 1, 34–40, illus., English and Spanish summaries.

The following conclusions were drawn : (a) yields of rough rice always exceeded 9000 kg./ha. ; (b) split applications of 150 kg. sulphate of ammonia and 200 kg. superphosphate per ha. gave increases in yield greater than those obtained by giving these amounts in one application ; (c) these fertilizers should be applied at the start of growth, at tillering and at earing ; (d) the inclusion of P_2O_5 in the fertilizer increased yields by 13·8%, against 8·4% from N alone ; (e) at 25-cm. intervals between holes transplanting 3–4 plants per hole was better than transplanting 7–9 plants per hole. F.s.—E.B.O.

1520 Williams, W. A. **Green manures and crop residues in managing rice soils.** [*Ext. Serv. Publ.*] *California Agric. Exp. Sta.* 1957, pp. 2, illus.

Practical recommendations are given for the use of a number of green-manure crops, including *Vicia atropurpurea, V. sativa, V. villosa, V. dasycarpa, V. faba, Pisum sativum* and *Medicago hispida.*—P.J.B.

1521 McNeal, X. **Rice aeration, drying, and storage.** *Bull. 593 Arkansas Agric. Exp. Sta.*, 1957, pp. 41, illus.

Experiments on the forced aeration of stored rice were carried out during 1945–55. Four sizes of bins were used, varying in capacity from 12 lb. to over 1000 bu. The rates of aeration were varied between 0·25 and 4·0 cfm./bu. Moisture content, percentage milling yields and percentage germination were determined for the rice samples after aeration. It was concluded that, for safe storage, the relative humidity of the intake air should be below 60%, the moisture content of the rice should not be above 20%, and the depth of the rice to be aerated should not be more than 8 ft. ; under these conditions the aeration rate should be at least 2 cfm./bu. Rice with a relatively high moisture content could be kept in good condition for a limited period using adequate aeration, and then dried in a grain drier. Partially-dried rice could be further dried to a safe moisture content by means of aeration. F.s.—R.B.

1522 FAO. **Joint report of the Seventh Meeting of the Working Party on Rice Breeding ; the Sixth Meeting of the Working Party on Fertilizers ; and the First Meeting of the *Ad Hoc* Working Group on Soil-water-plant Relationships of the International Rice Commission held at Vercelli, Italy, 23-28 September 1957.** *Meet. Rep. 1957/18*, 1957, pp. 55.

A summary is given of the discussions which took place at these meetings, attended by delegates and observers from 21 governments. The subjects discussed were, amongst others : production and distribution of high quality seed of improved rice varieties ; response to fertilizers and manures in recent trials ; relative efficacy of plant-nutrient carriers and time and method of application ; green manuring ; nursery manuring ; soil and plant analysis ; soil fertility and possibilities of increasing yields ; interaction between varieties and fertilizer response ; co-operative varietal trials ; research on soil-water-plant relationship. A summary of recommendations made, and a list of papers presented, are given.—E.B.O.

GENERAL

1523 van Dobben, W. H. Enige resultaten van oriënterend onderzoek over de rijenafstand bij granen. [**Preliminary cereal-spacing trial.**] *Rep. Exp. Fm "De Bouwing", Randwijk* [n.d.], 62–7. [Rec. 1958]

Tabulated information on the results of recent trials is presented, and the following conclusions are drawn. When there is no special reason for sowing in wider drills, wheat and barley should be sown in 22- to 25-cm. drills. In the case of rye and perhaps of oats a width of 28·6 cm. is preferable, because there is then less tendency to lodging. If, for reasons of mechanization or for enabling an undersown crop to develop better, it is desired to widen the space between drills, a width of as much as 33·3 cm. can be employed without noticeably impairing yield. If the space is widened to as much as 40 cm., as for a cover for grass sowing, the deterioration in yield will not exceed 10%. When the space between drills is widened, the quantity of seed must be proportionally reduced.—G.M.R.

1524 Savile, A. H. and others. **Notes on Kenya agriculture. 1. Cereal crops.** *E. Afr. agric. J.* 1958, **23**, No. 4, 228–33. [Dep. Agric., Kenya]

These notes, which are for the guidance of agricultural officers and farmers, deal with the soil and climatic requirements, cultivation, harvesting and uses of the following crops : maize (*Zea mays*), bulrush millet (*Pennisetum typhoideum*), finger millet (*Eleusine coracana*), golden millet (*Panicum miliaceum*), Italian millet (*Setaria italica*), rice (*Oryza sativa*), sorghum (*Sorghum vulgare*), barley (*Hordeum sativum*), wheat (*Triticum vulgare* and *T. durum*), oats (*Avena sativa*) and buckwheat (*Fagopyrum* sp.).—A.M.H.

1525 Winterlin, W. L. and others. **Stubble-mulch tillage versus plowing with nitrogen fertilization with regard to nutrient uptake by cereals.** *Agron. J.* 1958, **50**, No. 5, 241–3, bibl. 12. [Soil and Water Conserv. Res. Div. U.S.D.A. and Nebraska Agric. Exp. Sta., Lincoln]

No differences in Ca, Mg, K or P in maize, oats and wheat tissues and grain were found as a result of ploughing or stubble-mulching, but the

N content tended to be lower after mulching. N fertilizers raised the N contents of grain and straw but generally depressed the P levels and tended to remove the slight advantage, of ploughing over mulching, on grain yields.—M.H.F.

1526 Herrmann, P. Alte Erfahrungen und neue Gedanken zum Sommermenggetreidebau. **[Former experience and new ideas in the growing of summer cereal mixtures.]** *Bayer. landw. Jahrb.* 1958, **35,** No. 2, 144–55, bibl. 5. [Bayer. Landessaatzuchtanst., Weihenstephan]

General experience shows that, in places unfavourable for grain crops, better results can be obtained from growing mixtures of summer cereals rather than pure cultures. Experiments were made in growing mixtures of different varieties of oats and barley in different places (1953–7). Oats gave higher grain yields and starch-unit yields than barley, but the oats/barley mixture, in the last 2 years of the 1953–5 trial, gave a uniform and definite increase in yield compared with oats alone. Increasing the sowing rate of the mixture from 150 to 180 kg. per ha. did not increase yield. There was little difference in the yield of grain and starch units whether the proportions of oats and barley were 50 : 50 or 70 : 30. The composition of the crop harvested was subject to great fluctuation, governed in the first place by the seeds mixture used, then by ecological conditions and choice of varieties. Heavier sowing rate and heavier manuring encouraged the oats component. Study of the contribution made to yield by different oat and barley varieties showed that, contrary to the opinion hitherto held, it is advantageous to combine varieties ripening at different times. In addition, different combinations of awned oats with naked oats were tested and produced, in comparison with pure cultures of awned oats, somewhat lower grain- but higher starch-yields. This oat combination is considered very useful in view of its value in a cropping system, its resistance to lodging and tolerance of manuring, its good qualities as a cover crop and especially its reduced awn- and crude-fibre-content.—G.M.R.

1527 Thielebein, M. and Fischnich, O. Mähdrusch, Saatgutqualität und Sortenwahl. **[Combine-harvesting, seed quality and choice of variety.]** *Landw.- Angew. Wissensch.* 1957, No. 68, 5–42, bibl. 30, illus., English, French and German summaries. [Inst. PflBau und Saatguterzeugung, Forschungsanst. für Landwirtsch., Braunschweig-Völkenrode, W. Germany]

A cereal crop is ready for cutting when the transference of nutrients to the grain is complete. This stage can readily be determined by the eosin test, as follows. A sample of ear-bearing stalks is placed in a 1% aqueous solution of eosin. If the ears remain uncoloured throughout their length, the cereal crop is ready for cutting. When employing the combine harvester, the grain must also be ripe for threshing. Numerous germination and emergence tests proved that the threshing stage is reached when the grain-moisture content lies between 12 and 20%. This stage can readily be determined in the field, using an electrical moisture-meter. For storage, a moisture content of 14% is recommended and is obtained by artificial drying at a temperature not exceeding 36°C. Three weeks should elapse after threshing before testing for germination and emergence, if reliable results are to be obtained. Varieties suitable for the combine harvester are those in which the grain is firmly attached to the ear or panicle and which have a firm but pliable stalk. By complying with the above conditions grain of a quality suitable for sowing can be obtained.—D.B.

1528 Netherlands Institute for Research on Varieties of Field Crops. **Seed bulletin 1957 : Winter-sown cereals.** *Neth. Inst. Res. Var. Fld Crops, Wageningen,* 1957, pp. 15, illus.

1529 Netherlands Institute for Research on Varieties of Field Crops. **Seed bulletin 1957 : Spring-sown cereals.** *Neth. Inst. Res. Var. Fld Crops, Wageningen,* 1957, pp. 19, illus.

1530 Alberta Varietal Zonation Committee. **Varieties of grain for Alberta.** *Publ. 91 Alberta Agric. Ext. Serv.* 1958, pp. 6, illus.

1531 Caldwell, R. M. and others. **Small grain varieties for Indiana : recommendations for 1957 and performance 1950-1956.** *Sta. Bull. 646 Purdue Univ. Agric. Exp. Sta.* 1957, pp. 20, illus.

1532† Mukula, J. Saunakukan kemiallinen torjunta syysviljamailla. **Chemical control of scentless mayweed (*Matricaria inodora*) in winter cereals.** *Maatal. ja Koetoim.* 1958, No. 12, 188–93, illus., English summary. [Agric. Res. Centre, Tikkurila, Finland]

This plant occurs in Finland as a harmful weed in winter cereals, winter turnip rape and first-year leys. A mixture of the DNOC acid (3–4 kg./ha.) and the sodium salt of MCPA (1 kg./ha.) produced good control in winter cereals. The sodium salt of 2,4-D (1–1·5 kg./ha.) also proved effective. On the other hand, MCPA alone gave poor results. F. Eng. s.—M.H.

1533 Traaen, A. E. Kornbeiseforsøk 1950–1955. **Experiments regarding treatments of seed grain with disinfectants during the years 1950-1955.** *Forskn. Fors. Landbr.* 1957, **8,** No. 6, 417–31, bibl. 1, English summary. [Agric. Coll. Norway, Vollebekk]

Thirty different dust and liquid seed treatments were used for controlling *Helminthosporium gramineum* and *Ustilago jenseni* of barley, *Tilletia*

caries of wheat and *Ustilago avenae* of oats. The most effective were 3 types of panogen (panogen D.G.S.V., panogen 4925 and panogen 4930), aagrano 175, granosan N.I. and ceresan Bayer. All failed to some extent where the seed was heavily infected. F.S.—P.J.B.

1534 DE TEMPE, J. Aspecten van ontsmetting met kwikhoudende middelen bij zomergranen. **Aspects of mercurial seed dressing for spring cereals.** *Tijdschr. PlZiekt.* 1958, **64**, No. 2, 150–62, bibl. 6, illus., English summary. [Rijksproefstat. voor Zaadcontrôle, Wageningen, Netherlands]

The trials reported were carried out in the Netherlands during 1955–7 on samples of spring wheat grain infected by *Fusarium* spp. and spring barley infected by *Helminthosporium sativum*. Fungicidal seed treatments used were an organic Hg compound and thiram. The grain was sown in a heavy loam soil in early April. In trials with untreated seed, there was a rectilinear, negative relationship between the percentage of infected wheat or barley seed, on the one hand, and field emergence and plant weights at harvest. Data are also given of the relative increases in field emergence and plant weight caused by the treatment of seed with different percentages of infection. The use of organic Hg seed treatment resulted in differences of +14·5%, −3% and +4% in average plant weights of spring wheat in 1955, '56 and '57, respectively ; for spring barley, figures were +18%, +6·5% and −10%. In 1957, only, thiram was used and resulted in 30% greater average plant weights in wheat and 8·5% greater weights in barley, compared with untreated controls. The occasional reductions in plant weights following the use of Hg-containing treatments was ascribed to phytotoxicity caused by Hg. Thiram appeared to be superior to Hg treatments in its capacity to increase the emergence of seed with low vigour, though it had less direct effect on seed-borne pathogens. Data are given of the respective injuries caused by seed-borne inoculum and Hg treatments and of the percentages of infection in seed at which the beneficial and injurious effects of Hg treatments were in equilibrium during the 3 years. It was concluded that these results indicate the unsatisfactory nature of many aspects of the current routine use of seed disinfectants in the Netherlands.—P.J.B.

1535 SMITH, S. T. and TOMS, W. J. **Manganese deficiency in the cereal-growing areas.** *J. Dep. Agric. W. Aust.* 1958, **7**, No. 1, 65–70, bibl. 4, illus., map.

The soil-types and regions affected by Mn deficiency in Western Australia are described. The relative merits of soil application of $MnSO_4$ (14 lb./ac. incorporated with superphosphate) and foliage spraying (2 or 4 lb. $MnSO_4$ in 10 gal. water) are discussed. Soil application is reliable and more effective than spraying, but the latter is preferable in some circumstances, e.g., when the deficiency is not suspected at sowing or where affected patches are small and scattered.—A.M.H.

1536 ADER, F. Vergleichende Untersuchungen über die Brauchbarkeit des Tetrazolium-Verfahrens in der Routineprüfung bei Getreide. [**An examination of the usefulness of the tetrazolium method in the routine testing of cereals.**] *Saatgut-Wirtsch.* 1958, **10**, Nos. 2 and 3, 45–8, and 78–80, bibl. 42. [Pfälz. Landw. Untersuchungs- und Forschungsanst., Speyer/Rhein, W. Germany]

Though officially accepted as a seed-testing method in Federal Germany since 1949, the tetrazolium method has not been officially accepted in other countries, despite its advantages. In view of the criticism that it often indicates a viability higher than that obtained by the germinating-energy (brick-dust emergence) method, the results of testing 1022 seed samples by both methods have been analysed. The procedure itself has been critically studied and modifications are suggested regarding the pre-cooling temperature and the duration of pre-cooling.—D.B.

1537 FEDOROV, A. K. [**The passage of winter cereals through the vernalization phase under field conditions.**] [Russian] *Fiziol. Rast. (Pl. Physiol., USSR)* 1958, **5**, No. 1, 62–9, bibl. 2, English summary. [Inst. Genet., Acad. Sci., USSR, Moscow]

1538† SKRIPČINSKIĬ, V. V. **The relation between the work of organs of vegetative propagation in perennial and annual cereals and the process of seed formation.** [Russian] *Doklady Akad. Nauk SSSR (Proc. Acad. Sci. USSR)* 1958, **118**, No. 5, 1046–8, bibl. 10. [Stavropol Agric. Inst.]

It was known in 1821 (work of C. Reichert) that removal of stem buds induces branching in many plants which, normally, do not branch. Subsequently it was confirmed that in grasses tillering is enhanced when the stems are cut. The author's study was carried out with a perennial cultivated rye, with different varieties of annual cereals (rye, wheat, barley and oats), and with the amphidiploid hybrid (No. 927) between the winter Alabasskaja wheat and the perennial Anatoliĭskaja rye. Seeds of the winter crops were sown on 29 Sept. 1953 and the spring crops on 31 March, '54, in culture vessels (capacity 7 kg. soil) with 2 replications. Each vessel contained 4 experimental plants and 4 controls. In rye, wheat and the wheat/rye hybrid the stamens and ovaries were removed; in barley and oat the whole florets were removed. These removals took place after the beginning of earing and were repeated when each new ear

emerged. The controls fruited normally. The object was to discern the effect of the operation on (1) the dying of the existing stems and (2) the formation of new stems. The present paper is concerned primarily with (2). The numbers of living and dead stems present were counted at the earing stage, at the beginning of seed ripening, at full ripening and again somewhat later than full ripening. To distinguish new shoots formed after the operation from those formed earlier, the new shoots were tagged with thread. The data show that, in perennials, rendering the ears sterile rarely affected the formation of new shoots, which grew in considerable numbers. In the annuals, new shoots in the controls were extremely limited in number, while in the treated plants many new shoots were produced, although they were less numerous than in the perennials. The hybrid No. 927 was intermediate between the perennials and the annuals in this respect. A comparison of the morphological structure of the annual and perennial plants at the earing period show that they are similar in that in the lower nodes of the reproductive stems there are viable buds. However, the subsequent development of these buds is distinct ; in perennials they grow and produce new stems quickly while in annuals they wither after the plant has reached the stage of seed ripening. The significance of this is discussed in regard to the evolution of annual grasses from perennials and to the change of function in organs at a rudimentary stage.—M.H.

1539 Kokin, A. Ja. **Effect of micro-elements on physiological processes in cereal crops.** [Russian] *Fiziol. Rast.* (*Pl. Physiol., USSR*) 1957, **4,** No. 4, 345–51, bibl. 20, English summary. [Hertsen Pedagogic. Inst., Leningrad]

1540 Åberg, E. Skördeströskningen och strådädens kvalitet. **Combine harvesting and quality of the cereal.** *Sverig. Utsädesfören. Tidskr.* 1957, **67,** No. 4/5, 251–9, bibl. 8, English summary.

A review is given of some results of trials begun in Sweden in 1949 on the effect of either combine-harvesting before artificial drying (at 35°C.), or field-drying before threshing at a suitable stage of dryness, on different characteristics of the grain of 60 varieties of cereals, mostly winter wheat, and also of rye, oats and barley, at different stages of maturity. In trials during 1949–52 with winter wheat, early harvest of grain with a high moisture content resulted in reduced hectolitre weight in direct-combined grain ; field-drying of similar grain before threshing resulted in little reduction in hectolitre weight. Direct combining when binder-ripe also reduced hectolitre weight, whereas field-drying had no effect. Allowing crops to remain in the field in a dead-ripe state reduced hectolitre weight, mainly because of weathering. The germination, germinative energy and bread volume of grain harvested at an early stage of maturity was greatest in field-dried crops ; in crops harvested at a later stage, the differences in bread volume between field-dried grain and that direct-combined, vanished and even to some extent favoured the direct-combined samples. Direct-combining grain at a late stage of maturity resulted in grain with a lower diastatic activity than that field-dried, particularly in conditions of high temperatures. In less comprehensive trials with rye, results, broadly speaking, were similar to those for wheat. There were indications that direct-combining was particularly advantageous for rye, owing to its relatively greater tendency to sprout in the field and thereby yield grain with high diastatic activity. With oats, kernel percentages remained substantially unchanged as the grain matured beyond the yellow-ripe (ca. 25% moisture) stage. In studies on enzymatic changes in barley, it was noted that cellulase activity in both 2-row and 6-row varieties was closely related to weather conditions ; after warm, damp periods, cellulase contents rose where the grain had reached the binder-ripe stage. The content of sprouted grains in samples rose as cellulase contents increased. Observations are also made on investigations of harvest damage in barley.—P.J.B.

1541 Valle, O. Sääolot ja niiden vaikutus kasvintuotantoomme etela-Suomessa 1946–57. **Weather conditions and their influence on plant production in southern Finland in the years 1946-57.** *Maatal. ja Koetoim.* 1958, No. 12, 18–36, English summary. [Agric. Res. Centre, Tikkurila, Finland]

The material for this study is derived from observations made at the Department of Plant Husbandry at Tikkurila (lat. 60°18′N.). Phenological observations were made on Golden Rain II oats, Diamond spring wheat and Balder barley. There is also information on the winter survival of winter cereals and winter turnip rape. F. Eng. s. —M.H.

1542 Voigt, V. Der Einfluss der Witterung auf den Mähdreschereinsatz. [**Atmospheric conditions and combine-harvesting.**] *Landw.-Angew. Wissensch.* 1957, No. 68, 43–70, 2 maps, English, French and German summaries. [Inst. Physik und Meteorologie, Landw. Hochsch. Hohenheim, Stuttgart/Hohenheim, W. Germany]

The grain moisture-conditions requisite for employing the combine harvester, their dependence on atmospheric conditions, and the length of time (hr./yr.) during which they prevail have been studied over several years. The number of hours during which the grain-moisture content does not exceed 20% (17% for direct storage) has been determined at 97 observation stations throughout

W. Germany, and on this basis the country has been divided into 5 zones. Maps, one for a grain-moisture content of 20% or less, the other for 17% or less, show the number of hours per season during which the combine harvester can be operated in various parts of Western Germany. These maps show that the Palatinate, Hessen, and Baden-Wurttemberg are the most suitable, and Westphalia and the extreme N.W. are the least suitable regions for employing the combine harvester.—D.B.

1543 Smit, B. **The control of stored grain insects in South Africa.** *Bull. 355 S. Afr. Dep. Agric.* 1957, pp. 36, illus.

In South Africa, most grains are stored in bags on farms and in the up-country collecting centres before transport to the bulk-storage depots. The problems of protecting the grain from rodents and insects is discussed in relation to the constructional details of the storage premises ; suggestions are made for the dusting or spraying of stores prior to filling and the need for the fumigation of sweepings and tailings is emphasized. Details of stacking are outlined for the smaller farmer co-operative units and suggestions made for the protection of the grain with synergized pyrethrum preparations. The protective methods used in the larger storage depots are discussed. The advantages and disadvantages associated with storage in small tanks on farms are described. The fumigation with several other preparations is briefly summarized and suitable warnings are given concerning the handling and use of the more toxic substances.—M.H.F.

1544 Rothamsted Experimental Station. **Cereals.** *Rep. Rothamsted Exp. Sta. 1957*, Harpenden, 1958, pp. 316, 1 map.

1. Continuous recording of evaporation from a spring-wheat crop, p. 42. A recording balance used for evaporation or dew studies is described. Transpiration during active growth was of the same order as evaporation from a standard open water tank and reached a maximum of *c.* 5 mm./day in early June.

2. Rates of application of N for winter wheat, pp. 45–6. A low rate of nitro-chalk (52 lb. N/ac. in 1955 and 69 lb. N/ac. in 1956 and '57) increased yields by about 30% in 1955 and '56 and by 16% in 1957. The extra yield from a high rate of N (104 lb./ac. in 1955 and 139 lb./ac. in 1956 and '57) was 3·3 cwt. grain/ac. in 1955, 1·1 cwt./ac. in 1956 and 0·4 cwt./ac. in 1957, and was unprofitable in '56 and '57.

3. Effect of time of application of N to wheat, pp. 84–5. To test the hypothesis that response in grain yield to late N increases as the supply of N at early growth stages increases, wheat was grown in pots, with 3 levels of N applied in mid-March, with some plants receiving additional N in mid-March or late May. The response in grain yield to late N decreased with increasing basal N supply in March. At the lowest basal rate, additional late N increased grain yield mainly by increasing ear number, but at higher basal rates extra yield was produced mainly by ears already present when the late N was applied.

4. Varietal differences in barley, pp. 88–9. Differences in tiller survival of Plumage Archer and Proctor were investigated. In plants receiving no N, about half of the 1st primary tillers of both varieties survived to form ears ; almost all the 2nd primary tillers of Proctor also survived, but none of those of Plumage Archer. In plants receiving N [rate not stated] varietal differences occurred in the secondary tillers, of which 85% survived in Proctor and 14% in Plumage Archer. Removal of ears on older shoots shortly before emergence increased the number of ears at harvest in both varieties, but the effect was greater in Proctor. The increase was entirely due to increased tiller production and the survival of existing shoots was unaffected. Ear removal 2 weeks later or application of IAA (100 ppm. in lanolin paste) to the cut surfaces did not influence production or survival of tillers.

5. Dependence of net assimilation rate of barley on leaf-area index, pp. 90–1. [See also Abs. 807.] Net assimilation rate (E) decreased nearly linearly with increase in leaf-area index (L) over the range L = 2–9. The rate of decrease of E per unit increase in L was 6·9–7·2% of the value of E for L=1, a similar value to that for sugar-beet and lower than that for kale. The crop growth rate (dry-matter production/unit area of land) was maximal when L = 8–9.

6. Effect of competition with *Agrostis gigantea* on response of wheat to N top-dressing, pp. 93–4. In pot experiments, a late top-dressing (May) was less effective than earlier ones, in the absence of *A. gigantea*. In the presence of *A. gigantea*, response at all 3 dates (Feb.–May) was decreased.

7. Effect of sowing date, seed rate and N on Cappelle wheat, pp. 118–19. Mean grain yields were 51·9, 50·8, 49·1 and 46·7 cwt./ac. for plots sown on 18 Sept., 15 Oct., 8 Nov. and 4 Dec., respectively. Sept.–Nov. sowings yielded most at a seed-rate of 1·5 bu./ac. and the Dec. sowing at 4·5 bu./ac. Plots receiving 3, 6 and 9 cwt. ammonium sulphate/ac. yielded 52·4, 49·6 and 46·8 cwt./ac., respectively.

8. Control of wheat bulb fly (*Leptohylemyia coarctata*), p. 145. 4% dieldrin dust at 1 cwt./ac. broadcast on the soil surface in December gave slightly better control than a similar quantity combine-drilled with the seed, but the differences were not significant. Of organophosphorus sprays tested, the only one which significantly reduced tiller damage was 0·1% (v/v) parathion +

0·183% xylene + 0·014% atlox 3335 + 0·6% methyl cellulose ether. [See also Abs. 1843.]—A.M.H.

LEGUMES

COWPEAS

1545 Kavanagh, L. R. **Cultivation of cowpeas.** *Agric. Gaz. N.S.W.* 1958, **69**, No. 2, 79–83, illus.

Recommendations are made for suitable soils, methods of cultivation, seed rate, spacing, sowing-time and fertilizers. Two to five grazings may be obtained during the summer. If used as green manure, chopping before ploughing-in is recommended. Poona, Reeves, Cristaudo, Giant, Black, Honolulu and Victor are widely grown in New South Wales.—A.M.H.

SOYABEANS

See also Abs. 1409, 1451, 1779, 1852

1546 Vernetti, F. J. A cultura da soja. [**Soya-bean-growing (in Brazil).**] *Circ. 4 Inst. agron. Sul* 1956, pp. 10, bibl. 6. [Pelotas, Rio Grande do Sul, Brazil] [Received March, 1958]

1547† Sapin, P. Le soja à Yangambi. [**Soya-beans at Yangambi.**] *Bull. Inform. I.N.É.A.C.* 1958, **7**, No. 2, 105–15, illus. [Cent. Rech. Agron., Yangambi, Belgian Congo]

Soyabeans were introduced into the Belgian Congo about 20 years ago. The results obtained at Yangambi in improving this crop are summarized. Information is given on adaptation and cultural methods (rotations, spacing, yields). An agronomic classification of varieties, and the characteristics of the best ones, are also given. The late varieties (more than 125 days) are suitable for forage.—E.B.O.

1548 Berchoux, C. de. Étude sur la résistance de l'arachide à la rosette en Haute Volta. Premiers résultats. [**Study on rosette resistance of groundnuts in the Upper Volta.**] *Oléagineux* 1958, **13**, No. 2, 237–9, bibl. 3.

In a plot trial at Niangoloko, Upper Volta, on sandy, leached soil, several rosette-resistant groundnut varieties, selected at the Centre de Recherches Agronomiques, Bambey, Senegal, yielded about 1800 kg. of unshelled nuts per ha. with the application of 40 kg. sulphate of ammonia and 50 kg. bicalcium phosphate per ha. Six of these varieties yielded significantly more than the control, Rose locale, which is susceptible to rosette disease and 8 significantly more than Bambey 28.206, also susceptible.—E.B.O.

1549 Kato, I. and others. **On the study of soil heaping at the lower part of stem of soybean. 1. Investigations on the custom of soil heaping at the lower part of stem of soybean cultivated on foot-path in paddy fields. 2. On the rooting of adventitious roots and varietal difference.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 114–18 ; and 1957, No. 4, 69–73, bibl. 3, English summaries.

Crops of *Glycine soja* are raised on the paths which separate rice fields and, in Tokai-Kinki and elsewhere, there is an ancient cultivation practice of heaping soil and mud [from the rice field at weeding time] about the stem base of the soyabean plant. Results are given of a survey, covering 112 towns and villages, to investigate the prevalence of the procedures involved in this practice and the reasons for carrying them out. These last varied, and few farmers were aware of the beneficial effect of soil-heaping on soyabean yield. The growth stage at which soil heaping is done proved to be important. If done 28 days after sowing, many adventitious roots developed from the stem base, but if at 36 days, few developed. In the former case, the adventitious roots emerged from 1 to 4 weeks, and elongated during 15 to 40 days, after soil heaping. The new roots were 20% by weight of the old roots. There were varietal differences in adventitious-root formation. The number of roots, which was small in early varieties and large in late varieties, ranged from 11 to 80. [See also next abstract.] F. Eng.s.—D.B.

1550 Kato, I. and others. **On the study of soil heaping at the lower part of stem of soybean. 3. On the exudation of soybean plant and the influence of adventitious roots developed by soil heaping upon exudation.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1957, No. 5, 118–28, bibl. 14, English summary.

1551 Staniforth, D. W. and Weber, C. R. **Residual pre-emergence herbicides in soybean production in Iowa.** *Weeds* 1958, **6**, No. 2, 115–25, bibl. 8. [Iowa Agric. Exp. Sta., Ames]

The trials reported were carried out in Iowa on silt loam soils during 1949–55 with Hawkeye soyabeans. Major weed spp. present included : *Setaria viridis*, *S. lutescens*, *Polygonum pennsylvanicum* and *Amaranthus retroflexus*. Of herbicides applied pre-emergence, the following were effective as replacements for the first cultivation at about 2 weeks after sowing : 2,4-D isopropyl and butyl ester at 1 or 2 lb./ac., or CIPC, dinoseb, or NPA at 4 or 8 lb./ac. These treatments did not, in general, result in better weed control than that on cultivated control plots, or higher soyabean yields. In further tests, 2,4-D amine and micronized acid formulations of 2,4-D were used, but were not superior to 2,4-D butyl ester and were leached more rapidly from the soil. Herbicides did not

materially enhance the effectiveness of cultivations, particularly where early, shallow cultivation was carried out with a spike-tooth harrow. It was thought that residual, pre-emergence herbicides might have value for providing insurance against delay in early cultivation because of wet weather, or where cultivation technique is poor. The economic limitations on the use of such herbicides are noted.—P.J.B.

1552 LARSON, R. E. and others. **The effect of soil smoothing devices on the action of pre-emergence herbicides in soybeans and corn.** *Weeds* 1958, **6**, No. 2, 126–32, bibl. 7, illus. [Missouri Agric. Exp. Sta., Columbia]

In trials in Missouri on silt-loam soils, pre-emergence rolling and smoothing to reduce clods in plots sown with soyabeans decreased both stands and yields and also reduced the effectiveness of CIPC at 8 and 10 lb./ac., dinoseb at 6 and 7·5 lb./ac., and NaPCP at 10, 15 and 20 lb./ac. In all cases, the herbicides resulted in significantly higher yields than untreated, unweeded controls. Both grass and broad-leaved weed spp. were present. With maize, rolling by itself increased yields, though not significantly, but the use of a drag for smoothing did not. The use of 1 or 2 lb. 2,4-D ester/ac. significantly increased grain yields ; there was no significant herbicide × smoothing treatment interaction. Rolling, but not smoothing, tended to increase weed stands through increased weed seed germination in both soyabeans and maize.—P.J.B.

1553 WEBER, C. R. and STANIFORTH, D. W. **Competitive relationships in variable weed and soybean stands.** *Agron. J.* 1957, **49**, No. 8, 440–4, bibl. 8. [Iowa Agric. Exp. Sta., Ames]

Varying densities of artificially-sown or naturally-occurring weeds were allowed to grow in stands of soyabeans grown at different plant spacings and were removed at several stages of soyabean growth. Weeds caused increasing yield reductions as the soyabean stands were reduced below 9–11 plants per foot of row. Yield reductions were most severe when weeds were left in the crop until bean flowering ceased, or longer, but were less severe when there was a moisture deficit during the growing season. Infestations of *Setaria lutescens* and *Polygonum pennsylvanicum* caused equal yield reductions ; those caused by *Amaranthus retroflexus* were more severe. Dry-matter yields of the aerial portions of soyabeans + weeds were only slightly higher than those of weed-free beans. Weeds had little effect on time of maturity, height, lodging or seed size of the crop. Soyabeans spaced at 3 plants per ft. of row were somewhat less tall and lodged slightly less than at 9–15 plants per ft. The weight per 100 seeds was 0·2 g. greater for plants grown at the wider spacing. [See Abs. 1074 and *Fld Crop Abstr.* 10 : 563.] F.S.—R.B.

1554 SIRONVAL, C. **Relation between chlorophyll metabolism and nodule formation in soya bean.** *Nature, Lond.* 1958, **181**, No. 4618, 1272–3, bibl. 2. [Lab. Physiol., IRSIA, Inst. Bot., Liège]

[See *Fld Crop Abstr.* 9 : 467.] Results of the author's experiments with the Illini variety of soyabean indicated that the action of daylength on chlorophyll content in leaves is related in some way to daylength action on the formation of root nodules.—M.H.

1555 VAN SCHAIK, P. H. and PROBST, A. H. **Effects of some environmental factors on flower production and reproductive efficiency in soybeans.** *Agron. J.* 1958, **50**, No. 4, 192–7, bibl. 15. [Purdue Univ. Agric. Exp. Sta., Lafayette, Indiana]

Plants of the soyabean varieties Clark and Midwest were grown under controlled light- and temperature-conditions to study their effects on growth and reproduction. At 60° and 70°F. and 12-hr. daylength both varieties grew slowly and remained under-developed, while at 80° and 90°F. and 14-, 16- and 20-hr. photoperiods plants grew more quickly and attained greater final heights. Increases in temperature generally caused earlier and more abundant flowering in both varieties. With increase of daylength from 12 to 20 hours, flowering was delayed, but the number of flowers produced increased. Day temperatures of 80° or 90°F. in combination with lower night temperatures reduced the number of flowers produced by Midwest, but flower production in Clark was reduced only with day temperatures of 90° and night temperatures of 70°F. The first pod appeared sooner at 70°F. than at 60°F. ; above 70°F. pod appearance was delayed, but much more in Clark than in Midwest. At all temperatures, increase in daylength increased the length of flowering period in Clark, but produced inconsistent results in Midwest. At 60°F., no mature pods were produced by Clark during 12-hr. daylength treatments, nor by Midwest during 12-, 16- or 20-hr. days. High temperatures and long photoperiods increased the percentage of flower- and pod-shedding ; this was not caused by a lack of viable pollen. In field trials, the varieties Mukden, T109, Acc. 2300–2 and Midwest shed 43, 73, 62 and 81%, respectively, of flowers and pods. No shedding of flower-buds was observed. Shedding of pods comprised 33–50% of the total shedding. There was an apparent relationship between rising temperatures and increase in shedding. F.S.—R.B.

1556 BELIKOV, I. and KOSTECKIĬ, E. **The distribution of photosynthetic products in the soyabean plant at early phases of its**

development. [Russian] *Doklady Akad. Nauk. SSSR* (*Proc. Acad. Sci. USSR*) 1958, **119,** No. 6, 1236–9, bibl. 6. [Far-East Filial Acad. Sci. USSR, near Vladivostock]

From earlier studies [*Fld Crop Abstr.* 9 : 111 and 817] it was postulated that leaves at different levels on the stem supply assimilates to the developing reproductive organs which they subtend. From results of experiments designed to confirm this, it is concluded that, in *Glycine soja*, there is a tendency towards a local distribution of assimilates, not only during the reproductive phase, but also in earlier stages. Up to the reproductive phase the nutrients are translocated from leaves of the lower levels to the lower parts of the plant ; from the upper leaves the assimilates are translocated to young leaves and stem apices, while from the central layers of leaves the nutrients are dispersed to both the upper and lower parts of the plant. Thus, the assimilates are translocated from their source to the nearest part of the plant where they are needed.—M.H.

1557 Hawkes, G. R. **Some factors affecting the nitrogen nutrition of the soybean.** *Diss. Abstr.* 1957, **17,** No. 12, 2754–6. [Ohio State Univ., Columbus]

In 2 years' trials, soyabeans were grown, using gravel-culture techniques, in which different levels of N were supplied in nutrient solutions, or in ion-exchange materials, at the early-growth-, flowering-, or pod-development-stages. In the second years' trials, amounts of K, P, Ca and Mg were also varied. Soyabeans were unable to accumulate enough N during the pre-bloom stage to produce the highest seed yields. Inoculation with an effective strain of *Rhizobium japonicum* eliminated the effect of low N levels in the nutrient solution and raised seed yields, even at high N levels (100 ppm.). Inoculation, alone, did not provide enough N for highest seed yields. Inoculation resulted in significant increases in the N content of the seed ; different levels of N in the culture solutions affected total seed yields, only.—P.J.B.

1558 Mederski, H. J. and Hoff, D. J. **Factors affecting absorption of foliar-applied manganese by soybean plants.** *Agron. J.* 1958, **50,** No. 4, 175–8, bibl. 8. [Ohio Agric. Exp. Sta., Wooster]

A 1% $MnSO_4$ solution in contact with the leaf surface of intact soyabean plants grown in a greenhouse increased the plant Mn-concentration by 84 ppm. After 15 min. of contact, the plant Mn-concentration increased by 230 ppm. The increase in plant-Mn was 3–6 times greater when a 5% rather than a 1% solution was used. Some of the accumulated Mn appeared to have been adsorbed on to the leaf and could be removed by washing with a $NaNO_3$ solution. Adsorption may be the first step in the foliar absorption of Mn or may be coincidental to accumulation. Leaves and stems of plants immersed in a 0·1% $MnSO_4$ solution accumulated 2–3 times more Mn from solutions at 69°F. than from solutions at 36°F. Mn absorption continued after the water in the applied solution evaporated, when the relative humidity was 60–80%. With a high vapour-pressure gradient, little, if any, absorption took place after the solution had dried. The increase of Mn concentration in upper leaves dipped in 5% or 1% solutions was approximately twice that occurring in lower leaves dipped in the same solutions. Middle leaves from plants whose upper leaves had been dipped in 5% solution showed 5 times the increase in Mn content shown by middle leaves of plants whose lower leaves had been dipped in the same solution. Where 1% solution was used, no detectable increase in Mn concentration occurred in the remaining undipped leaves.—R.B.

1559 Rojas-Garciduenas, M. and Kommedahl, T. **The effect of 2,4-dichlorophenoxyacetic acid on radicle development and stem anatomy of soybean.** *Weeds* 1958, **6,** No. 1, 49–51, bibl. 3, illus. [Univ. Minnesota, St. Paul]

1560 Meade, J. A. **Effect of isopropyl N-(3-chlorophenyl) carbamate on the carbohydrate content of soybean plants.** *Weeds* 1958, **6,** No. 1, 66–7, bibl. 12. [Maryland Agric. Exp. Sta., College Park]

1561 Weber, C. R. and Horner, T. W. **Estimates of cost and optimum plot size and shape for measuring yield and chemical characters in soybeans.** *Agron. J.* 1957, **49,** No. 8, 444–9, bibl. 7.

Experiments to determine the most satisfactory shape and size of plots to be used in investigating seed yield, protein content, oil content and oil iodine-number were carried out, using 1088 plots with a basic size of 8 ft. long and one row (2 ft.) wide. Varying plot sizes and shapes were produced by combinations of basic plots. Average coefficients of variation were : yield, 8·4% ; oil, 1·5% ; protein, 1·3% ; iodine number, 0·3%. Yield was 6–28 times as variable as the chemical characters. Optimum plot size for investigating all characters was 3·2 times the basic size, and for yield alone, 3·1 times the basic size. Yield investigations required 33 times as much replication as oil, 50 times as much as protein, and 700 times as much as iodine number for comparable precision. Using plots twice the basic size, yield replications required to be increased by 33% for comparable precision. Using incomplete block designs, long, narrow plots gave a greater gain in precision (46·3%) over randomized complete blocks than did shorter, wider plots (17·7%). F.S.—R.B.

GROUNDNUTS

See also Abs. 1708, 1751, 1809, 1850, 1852

1562 Sankaran, R. **Increased production of groundnut in India through intensive cultivation.** *Indian Oilseeds J.* 1958, **2**, No. 1, 35–46.

Data are given on acreage, utilization and export of *Arachis hypogaea* during the period of the first Five-year Plan. Improved cultivation practices for the states of Andhra Pradesh, Bombay, Madras, Punjab, Uttar Pradesh and Mysore are tabulated. The practices are detailed under the headings : preparatory tillage, manuring, sowing (time, method, spacing, sowing rate), intercultivation, fertilizer application, irrigation, plant protection, and harvesting. For each of the above States a list is given of improved varieties, together with details of their growth habit, yields and acreage.—D.B.

1563 Catherinet, M. Un nouveau type variétal d'arachide : le type Boukombé. [**A new varietal type of groundnut : Boukombé.**] *Bull. agron. Fr. d'out. mer* 1957, No. 15, 45–8, bibl. 4, illus. [Cent. Rech. Agron., Bambey, Senegal]

In the groundnut collection at Bambey certain varieties from Dahomey and the Ivory Coast present special characters which allow them to be grouped as a new type, named Boukombé after the place from which the first variety of this type in the Bambey collection came. The type is of interest for genetic studies and, possibly, for consumption in climates where it can mature in a longer growing season than that of Bambey.—G.M.R.

1564 Tarr, S. A. J. **Control of seed-bed losses of groundnuts by seed treatment.** *Ann. appl. Biol.* 1958, **46**, No. 2, 178–85, bibl. 1. [Bot. Dep., Univ. Exeter]

Fungicide treatment of *Arachis hypogaea* seed usually reduced seed-bed losses and improved emergence, plant populations and yields of this crop when cultivated under rain in the sandy soils of Kordofan (west-central Sudan) or under irrigation in the alkaline clay soils of the Gezira. These beneficial effects were greatest with slightly damaged seeds, such as would occur with machine sowing, but were present even when selected undamaged seed was sown by hand ; they were attributed to protection against a number of soil micro-organisms. Agrosan GN (organo-mercurial, 1% mercury equivalent) or 50% thiram powder, both applied at the rate of 1 g./lb. of groundnut seed, are suggested as suitable seed dressings in the two areas studied. F.S.—M.H.

1565 Catherinet, M. Étude sur le port de l'arachide cultivée. [**Study on the habit of the cultivated groundnut.**] *Bull. agron. Fr. d'out. mer* 1957, No. 15, 34–44, bibl. 17, illus. [Cent. Rech. Agron., Bambey, Senegal]

The habit of the groundnut is characterized by branching, the way in which the branches emerge from the soil and some secondary characters such as dwarfing, leaf shape and colour. Ten types of habit are distinguished, 4 of which are frequently found among the most widely cultivated varieties : unbranched erect ; sub-branched erect ; branched erect ; and branched creeping. This classification enables rapid differentiation to be made in studying types and varieties.—G.M.R.

1566 Bolhuis, G. G. **Observations of the flowering and fructification of the groundnut, *Arachis hypogaea*.** *Neth. J. agric. Sci.* 1958, **6**, No. 1, 18–23, bibl. 5. [Buitenzorg General Agric. Exp. Sta., Buitenzorg, Java]

Three groups, each of 10 plants, of the groundnut Spanish bunch variety Schwarz 21 were grown at Buitenzorg, Java, 2 groups being sown in pots in November and February (beginning and end of the wet season), the third being sown in the open in June (middle of the dry season). The differing climatic conditions had little effect on the flowering cycle of the plants.—R.B.

1567 Oléagineux. Diagnostic foliaire de l'arachide : instructions pour le prélèvement. [**Foliar diagnosis in groundnuts : instructions for sampling.**] *Oléagineux* 1958, **13**, No. 2, 259–60, illus. [Inst. Rech. Huiles et Oléagineux, Paris]

Sampling for foliar diagnosis in groundnuts is made by taking the 4th order leaves (not considering the cotyledonary branches) on the principal stem of plants at the beginning of flowering. Instructions are given on : choosing the plants ; sampling technique ; conditioning the samples ; and sampling from plants showing deficiency symptoms.—E.B.O.

1568 Faure, J. and Ginouves, J. Note sur une méthode de détermination rapide des besoins en potasse de l'arachide par l'analyse des sols. [**A rapid method for determining the potassium requirements of the groundnut by soil analysis.**] *Bull. agron. Fr. d'out. mer* 1957, No. 15, 88–91. [Cent. Rech. Agron., Bambey, Senegal]

1569 Wahhab, A. and Muhammad, F. **Nitrogen and phosphorus fertilization of peanuts (*Arachis hypogaea*).** *Agron. J.* 1958, **50**, No. 4, 178–80, bibl. 8. [Agric. Coll., Lyallpur, W. Pakistan]

N and P fertilizers were applied alone and in combination to groundnuts in a W. Pakistan region with 15- to 18-in. rainfall during the growing season. Application of 37·5 lb. available P_2O_5/ac. resulted in an average increase in yield of 257 lb. nuts/ac. Under favourable conditions, increased yields from this amount of P_2O_5 reached a maximum of 520 lb./ac. N alone caused insignificant

increases in yield, but increased vegetative growth. In combination with P, N applications reduced the beneficial effect of P. F.S.—R.B.

1570 Ginouves, J. and others. Vue d'ensemble sur les campagnes 1954–1955 d'essais multilocaux d'engrais NPK sur arachide au Sénégal. [**General survey of trials with NPK on groundnuts in Senegal carried out in several localities in 1954-5.**] *Bull. agron. Fr. d'out. mer* 1957, No. 15, 67–87. [Cent. Rech. Agron., Bambey, Senegal]

The geographical distribution of the trial plots is mapped. Five NPK formulae were compared. Results in 1954 showed the beneficial action of formulae with a predominance of N when there was rosette attack, but wherever this was not serious, the superiority of the commercial formulae 6–20–10 (especially for the south and eastern regions) and 10–14–8 (in the old cultivated regions) was apparent. The results of 1955 trials confirmed the 1954 findings, and stressed the value of the 6–20–10 formula for southern Senegal.—G.M.R.

1571 Bagot, Y. and Servant, M. Contribution à l'étude de la conservation de quelques graines oléagineuses d'origine tropicale. [**A contribution to the study of the storage of some tropical oil seeds.**] *Oléagineux* 1958, **13**, No. 1, 57–61, bibl. 2. [Inst. Rech. Huiles et Oléagineux, Paris]

The storage of groundnut seed was studied for one year in Paris, using seed of the varieties Bambey 28.206 and Tivaouane 31–33 from Senegal. Results showed that : (a) the seed of the 2 varieties behaved in the same way ; (b) the acidity of whole seeds (shelled or unshelled) did not vary, or increased only slightly without exceeding 0·8%, with 1-yr. storage at 32°–35°C. and a relative humidity not exceeding 70%.—E.B.O.

PEAS

See also Abs. 1710, 1726, 1775

1572 Proctor, J. M. **Pea growing handbook.** 1958, pp. 96, illus., London and Peterborough : Pea Growing Res. Org., Ltd., 2s.

The subject is dealt with under the headings : general husbandry, including climate and soil, place in rotations, cultivation, manuring, varieties, seed-quality, seed-dressing, seed rates and row-widths, sowing date and weed control ; pests and diseases ; harvesting. There is also a key for the diagnosis of the principal disorders of peas.—A.M.H.

1573 Riepma Wzn, P. Enige resultaten van het peulvruchtenonderzoek. [**Studies of pulse-growing.**] *Rep. Exp. Fm "De Bouwing", Randwijk* [n.d.], 68–70. [Rec. 1958]

The choice of pea varieties for industrial use presents difficulties because different characters are required for canning and freezing, respectively. Peas of the Alaska type from America are in great demand but their yield in the Netherlands is often disappointing. Many pea varieties have been under trial at De Bouwing from 1952–5 for their culinary as well as their agricultural properties. In a comparison of 3 canning-pea varieties, the early and short Gloire de Quimper required a dense stand, the optimal number of plants being 105 or more per sq. m. ; while Celsior, a medium-early variety, did not require more than 55–70 plants per sq. m. Lincoln occupied a mean position between the 2 varieties in this respect and gave the highest yield. From trials of different apparatuses for the field-drying of peas (seed and straw), the roofed hurdle is preferred to the tripod.—G.M.R.

1574 Reynolds, J. D. **Trials of Dutch threshed pea varieties : 1949-1952.** *J. nat. Inst. agric. Bot.* 1957, **8**, No. 1, 82–95, bibl. 9. [Pea Growing Res. Org., Ltd., Yaxley, Peterborough]

Results are presented of 41 trials in 1949–52 comparing the varieties Servo, Unica, Rondo, Mansholt's G.E.K., Stijfstro, Emigrant and Zelka. Information is provided on the field characters of the varieties tested, and field conditions and yield data are tabulated. The effects of season, soil type and fertility on yield and the influence of variety on the texture of the peas when canned as "processed peas" are discussed. The blue variety Servo was consistently the highest yielder (mean 25·3 cwt./ac.). All the blue varieties tested, as well as the marrowfat variety Emigrant, frequently outyielded Zelka (marrowfat). F.S.—A.M.H.

1575 Netherlands Institute for Research on Varieties of Field Crops. **Seed bulletin 1957 : Peas and field beans.** *Neth. Inst. Res. Var. Fld Crops, Wageningen*, 1957, pp. 12, illus.

1576 Schipstra, K. Onkruidbestrijding in erwten. [**Weed control in pea crops.**] *Tech. Ber. Peulvrucht.* 1958, No. 76, pp. 11, illus.

The following are some of the points contained in this advisory bulletin. On clay soils, rolling, hoeing and harrowing supplemented by one or two applications of DNBP spray, will effect the control of most annual weeds, but on sandy soil much tillage is inadvisable. In using DNBP, the weather before, during, and after, spraying plays an important part. This chemical affects the seed yield of peas favourably but generally reduces straw yield somewhat. For chickweed [*Stellaria media*] and mayweed [*Matricara inodora*] DNBP has insufficient effect and calcium cyanamide can be used when the crop plants are approximately 5 cm. high, but on light, dry, and acid soils this chemical is not without risk to some pea varieties. DNC can be used just before the crop plants come up, and when much water is used chickweed and mayweed can be controlled. A good and sometimes cheaper effect can also be obtained from

rolling before the crop emerges and hoeing and harrowing after its appearance. DNBP can also be used for the destruction of late-germinating annuals such as corn marigold [*Chrysanthemum segetum*] (applied when the weed overtops the pea plants, which at this stage generally suffer no injury from the chemical). For other weeds such as *Agropyron repens*, *Tussilago farfara*, *Cirsium arvense*, *Sonchus oleraceus*, no good means of chemical control are yet available, and land infested by such should preferably be avoided for growing peas. Annual grasses such as *Alopecurus myosuroides* and wild oats in peas cannot be controlled by chemical means. Spraying with IPC some 14 days before sowing the peas, sometimes recommended for the purpose, can injure the crop plants considerably, and cultural measures for control should preferably be used.—G.M.R.

1577† Rosselet, F. and van Blommestein, J. A. **Do farmers have any success with inoculation of peas** ? *Fmg in S. Afr.* 1958, **34**, No. 3, 23–5, bibl. 5, illus. [Citrus and Subtrop. Hort. Res. Sta., Nelspruit]

Spergon, fernasan and ceresan, used to control bacterial blight (*Pseudomonas pisi*) of peas, were not particularly harmful to nodule bacteria, when these were inoculated into the soil and were not in direct contact with the disinfected seed. On inoculated seed, spergon and fernasan caused slight depression of nodulation and ceresan was highly toxic to the nodule bacteria.—A.M.H.

1578 Henkens, C. H. Voorkómen van kwade harten in erwten door bespuiting met mangaansulfaat. [**Prevention of hollow-heart defect in peas by spraying with manganese sulphate.**] *LandbVoorl.* 1958, **15**, No. 6, 262–5. [Inst. voor Bodemvruchtbaarheid, Groningen]

In 1957, 3 trial fields of (a) Zelka marrowfat peas, (b) and (c) Aureool dun peas, were sprayed with 1·5% $MnSO_4$ solution at 1000 l./ha. Fields (a) and (b) were sprayed (1) before flowering ; (2) at the beginning of flowering ; (3) in full bloom ; (4) at the end of, or just after, flowering. Field (c) received treatments (1), (2) and (4). Treatments were applied singly or in combination. Field (a) control was 78% defective. Plots in (a) given treatments including treatment (3) showed 16·5% of the defect. Plots given treatments including (3) and (4) showed only 9·5% of the defect. Field (b) control was 42% defective ; treatment 3 alone was sufficient in most cases to prevent the defect, and combinations of (2) and (4) prevented the defect in some plots. In field (c), treatment (2) prevented the defect only when followed by treatment (4). Treatment (1) had no effect.—R.B.

1579 Björn, L. O. and Virgin, H. I. **The influence of red light on the growth of pea seedlings. An attempt to localize the perception.** *Physiol. Plant.* 1958, **11**, No. 2, 363–73, bibl. 16. [Pl. Physiol. Inst., Lund, Sweden]

1580 Riepma Wzn, P. De reactie van erwten op de zaaitijd. **The response of peas to time of sowing.** *Jaarb. Inst. biol. scheik. Onderz.* 1957, 123–30, bibl. 10, English summary and table heads.

In a sowing-date trial in spring with five varieties of pea, the three long-day varieties started flowering not much later than the two varieties which are not affected by daylength (Gloire de Quimper and Kelvedon Wonder). Sown in August, however, they had a considerably longer vegetative period than the other two, although the average daylength in the first 3 weeks after emergence was in late summer the same as in spring. This may be explained by the fact that daylight reaction depends on temperature. A daylength which is optimal in spring may be sub-optimal in summer. All five varieties tillered less when sown later, and the number of pods, the number of seeds per pod and the 1000-seed weight were also lower. F.s.—G.M.R.

1581 Kreyger, J. and others. Oriënterende bewaarproeven met kapucijners en rozijnerwten. [**Preliminary storage experiments with dun and maple peas.**] *Tech. Ber. Peulvrucht.* 1958, No. 77, pp. 8, illus. [Wageningen]

The storing of these peas from one year to another would assist in stabilizing the market by avoiding great fluctuations in price and production. Commercial samples of dun peas (variety Aureool) and maple peas (variety Koroza) from the 1954 and 1955 crops were stored for 1, 2, 4, 8 and 16 months at temperatures of 2, 10 and 20°C. and under relative atmospheric humidities of ± 75% and 85%. The effect on moisture content, germination capacity, colour and culinary value was studied. Storage for a year at both 2°C. and 10°C. maintained the desired qualities in the peas, provided that certain precautions for maintaining moisture content were taken, but storage at 20°C. was not successful. Further experiments will test storage at temperatures between 2° and 10°C.—G.M.R.

VETCH

1582† Kawatake, M. and others. **Studies on the developmental processes of hard seed of some legumes. 5. The length of funiculus and germination of *Vicia sativa* L. var. *normalis* Makino.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 123–5, bibl. 4, English summary.

Since in previous anatomical studies on seeds the length of the funiculus was positively correlated with the thickness of the outer-integument and judged therefore to have a bearing on hardness of

seed, the relationship between length of funiculus and germination rate was investigated in *V. sativa*. In any pod the funiculus length varied considerably, between 0·4 mm. and 1·2 mm. Seed with short funicula germinated earlier than those with long funicula. F. Eng. s.—D.B.

1583† Rasmussen, L. H. **Trial plantings of hairy vetch in western Fremont county, Wyoming.** *Wyo. Range Mgmt Issue 98*, 1956, pp. 2.

Inoculated seed of *Vicia villosa* was sown with oats at a rate of 20 lb. vetch seed and 40 lb. oat seed/ac. Good nodulation ensued, and the oat yield was 63 bu./ac. Yields of oats the following year were 129 bu./ac. After harvesting the oats, the stubble was irrigated and steers grazed the vetch, without bloat symptoms developing. It was estimated that the vetch fixed 100 lb. N/ac.—R.B.

LUPINS

See also Abs. 1724

1584† Rijkslandbouwconsulentschap voor Noord-Limburg, Horst. Meded. No. 2. Nieuwe aspecten van de lupinezaadteelt. [**New aspects of lupin seed-growing.**] *Suppl. Peulvrucht. Stud. Comb.* 1957, pp. 7, mimeo.

Inadequate supplies of seed hamper the extension of lupin-growing in the Netherlands. They are largely attributable to the risks of disease which attend lupin seed-growing and to the costly labour incurred in weed control. It is suggested that mosaic disease may be prevented by the use of sound seed and by early sowing, and wilt disease by means of a good rotation. Experiments (described) have led to the following conclusions. Use of the right cultural measures combined with a DNC spray applied shortly after sowing, and just before the crop plants come up, reduces the labour of hoeing and weeding. The highest seed yield, and, above all, the best quality seed result from using a wide drill width (about 50 cm.) together with a heavy sowing rate (100 kg. per ha.) and early sowing.—G.M.R.

1585† Eksteen, L. L. and Beyers, C. P. **The influence of lime and phosphatic fertilizers on the growth and nutrient uptake of the blue-bitter lupin, *Lupinus angustifolius*.** *S. Afr. J. agric. Sci.* 1958, **1**, No. 1, 25–41, bibl. 4. [Stellenbosch-Elsenburg Coll. Agric., Stellenbosch]

A fertilizer experiment was carried out on a sandy soil of low nutrient status. The effects of annual applications of 50 lb. P_2O_5/morgen [1 morgen = 2·1165 ac.] as superphosphate, Langebaan rock phosphate or North African rock phosphate, with or without lime or dolomitic limestone, were compared with the residual effects over 4 yr. of initial applications in 1950 of 100 lb. P_2O_5/morgen in each of the 3 forms. The crops were ploughed in at the full-flowering stage, except in 1954. The plant weights showed a marked response to P. The residual effects of the 1950 P treatments declined in 1952 and '53, the weight of P per plant decreasing before the % P. The % P in plants receiving annual applications of P tended to rise. Liming had apparently no effect on yield. Weight differences between fertilized and unfertilized plants were most marked after the flowering stage, when the maximum increase in dry weight took place. The P-, Ca-, K-, Mg- and N-contents of plants under 4 fertilizer treatments and at 7 stages of growth are tabulated. The total cations, as M.E./100 g. plant material, decreased with age, but was approximately constant for all treatments at any particular stage. K appeared to be the most important nutrient, as large amounts were absorbed at a high rate throughout the growing period. In a rotation experiment, the weight/20 plants of young oats was 2·9 g. after fallow ; 5·3 g. after lupins for silage ; and 8·3 g. after lupins as green manure ; % N contents for the 3 treatments were 2·78, 3·69 and 4·15, respectively, and % K contents 2·53, 2·22 and 3·48, indicating the large amount of K removed by the lupin crop. The total yield of unfertilized plants was 22·6% and the pod yield about 50% that of the fertilized, indicating that in erratic rainfall areas where seed production is the aim, heavy fertilizing may not be desirable.—A.M.H.

1586† Peulvruchten Studie Combinatie, Wageningen. Inleidingen lupinedag 14 Juni 1957. [**Papers presented to the Conference on Lupin-growing, 14 June, 1957.**] *Peulvrucht. Stud. Comb.* 1957, pp. 22, mimeo.

Three of the four papers presented were : (1) Inspection of seed cultures of the yellow lupin [*Lupinus luteus*] by the Netherlands General Inspection Service, by A. C. Buys, pp. 3–5. The lupin grown in the Netherlands is the so-called sweet or alkaloid-free yellow lupin, and inspection is concerned chiefly with the amount of bitter seed found, only a very small percentage being admissible. (2) Weed control in lupin cultures, by R. Prinsen, pp. 6–9. Good results have been obtained in the Veluwe from DNC, and the method for using it is outlined. (3) Problems in sweet lupin cultivation in Limburg, by J. Vranken, pp. 10–15. Among aspects treated are the emergence of bitter plants among the alkaloid-free, wilt caused by *Fusarium oxysporum*, mosaic disease in seed cultures, difficulties in growing the sweet lupin in loess soils, and root-nodule formation in *Lupinus luteus*.—G.M.R.

CHICKPEAS

1587 Dharampal Singh, and Sahai, J. M. **A new gram and a new arhar for U.P. farmers.** *Indian Fmg* 1958, **8**, No. 1, 15–16, illus.

A new variety of *Cicer arietinum* for the Bundel-

khand area of Uttar Pradesh combines the earliness and bold seed of the local variety Banda with the high yield of T87. This new variety, known as Type 1, has a spreading habit and large brown seeds, and matures in 145–150 days, or earlier. The average yield is 18 maunds/ac. ; under good conditions it can produce 30 maunds/ac. The new variety of *Cajanus cajan*, Type 105, yields an average of 18 to 22 maunds/ac. and matures about 10 days earlier than the previously cultivated Type 17. At the same time it retains the wilt resistance and good cooking-quality of Type 17. [1 maund = 82 lb.]—D.B.

1588 PATIL, J. A. **"Chafa"—an improved strain of gram.** *Farmer, Bombay* 1958, **9,** No. 2, 33–4, illus. [Agric. Res. Sta., Niphad, Bombay State]

The leaf, flower and seed of the Chafa strain of *Cicer arietinum* are described. This strain matures in 105 days, which is 5 days earlier than the local variety. It yields about 850 lb. seed/ac. which is 12% higher than that of the local variety. It gives a high percentage of puffed grain.—D.B.

1589 ARORA, N. **Histology of the root nodules on *Cicer arietinum* L.** *Phytomorphology* 1956, **6,** No. 3/4, 367–78, bibl. 25, illus. [Dep. Bot., Univ. Delhi, India] [Received November, 1957]

GENERAL

1590 ALLOS, H. F. **Influence of inorganic nitrogen on the inhibition of symbiotic nitrogen fixation.** *Iowa State Coll. J. Sci.* 1957, **31,** No. 3, 350–1. [Received May, 1958]

Nitrogen [rates not stated] was added to a number of legumes, including soyabeans, and to Sudan grass [*Sorghum sudanense*] and 2 other grass spp., grown in gravel cultures. In all but one legume, the lowest rate of N applied resulted in increased fixation of atmospheric N. With soyabeans, but no other legume, N fixation was greatest where the highest rate of N was applied. N fixation was directly related to the total dry-matter production of the legumes ; soyabeans fixed most N and grew more rapidly than any other. Recoveries of added N ranged from 76–94% for the legumes and 79–97% for the grasses. —P.J.B.

ROOT CROPS

SUGAR-BEET

See also Abs. 1619, 1800, 1806, 1829, 1843

1591 MYRICK, D. C. and HUFFMAN, R. E. **Sugar beet production in Montana.** *Bull. 525 Montana Agric. Exp. Sta.* 1956, pp. 96, illus.

A description is given of current methods for the growing and harvesting of sugar-beet in Montana with and without irrigation.—R.B.

1592 FINNEY, D. J. and WEST, W. J. **The cultivation of sugar beet in Scotland. Six methods compared.** *Brit. Sug. Beet Rev.* 1958, **26,** No. 3, 117–21. [A.R.C. Unit of Statistics, Univ. Aberdeen and N.I.A.E. Scot. Sta.]

On average, growing on the flat gave lower root weights and sugar contents than growing on ridges, but differences in plant population and weight of tops were small. Concentration of fertilizer in the ridges markedly decreased yields of beet and sugar and slightly decreased sugar %. All these effects were less noticeable with 22-in. rows than with 26-in. rows. For beet grown on ridges with fertilizer broadcast, some increase in yield and sugar content still resulted when row-widths were reduced from 26-in. to 20–22 in. Supplementary row-spacing experiments suggested that an extra 0·75 cwt. sugar/ac. could be expected from the narrower spacing.—A.M.H.

1593 COCK, J. H. **Early drilling : an important factor in yield [of sugar-beet].** *Brit. Sug. Beet Rev.* 1958, **26,** No. 3, 113–14, 136. [E. Anglican Real Property Co. Ltd.]

Practical recommendations are made concerning cultural operations in Britain. Time of drilling is one of the most important factors determining yield. Sowing before the end of April is recommended.—A.M.H.

1594 MAUGHAN, G. L. **Through thick and thin.** *Fmr's Wkly, Lond.* 1958, **48,** No. 20, 10–12 (Suppl.), illus. [N.I.A.E.]

The technique of mechanical thinning of sugar-beet is discussed and the advantages considered in relation to labour problems and costs.—A.M.H.

1595 RID, H. Möglichkeiten der Arbeitsersparnis und Arbeitserleichterung in der Rübenpflege. [**Saving and lightening of labour in sugar-beet cultivation.**] *Bayer. landw. Jahrb.* 1958, **35,** No. 1, 3–35, bibl. 19, illus. [Landesanst. Pflanzenbau u. Pflanzenschutz, Munich]

The necessity for reducing a sugar-beet stand in early spring to approximately 100 thousand plants per hectare, of which some 80 thousand will eventually remain and be adequate for obtaining maximum yields, has hitherto entailed much labour in singling. This may be reduced by using seed drills designed to provide light stands and thus eliminate the need for singling. Trials were made in 12 places, and on very different soil types, of 2 mechanical and 2 pneumatic single-grain-sowing machines. Labour was found to be reduced as follows : compared with the use of monogerm seed, 30% ; compared with normal sowing, 40%. Another way of reducing labour is by using mechanical singlers, and a trial of one of these showed the reduction, with a sowing rate of 30 kg. normal seed per ha., to be between 16 and 26%. Both

means for reducing labour can be valuable under the right conditions.—G.M.R.

1596 Virnes, E. Harvennusajan vaikutuksesta sokerijuurikkaan satoon. **Effect of thinning time on the yield of sugar beet.** *Maatal. ja Koetoim.* 1958, No. 12, 204–7, English summary. [Agric. Res. Centre, Tikkurila, Finland]

In 1947, 1948, 1950 and 1952 the effects of time of thinning on the yield of sugar-beet were studied. The seed rate was 25 kg./ha. Under the conditions of South Finland, the beet must be thinned within about 2 weeks from emergence. F.Eng.s.—M.H.

1597 Bradford, C. M. **First and foremost.** *Fmr's Wkly, Lond.* 1958, **48**, No. 20, 8–9 (Suppl.), illus. [Brit. Sug. Corp., Ltd.]

The conditions which are necessary in England for the successful mechanization of spring work with sugar-beet are considered. In particular, the technique of seed-bed preparation is discussed.—A.M.H.

1598 Roussel, N. L'influence du retardement de l'arrachage sur le comportement de quelques variétés de betteraves sucrières. [**The effect of a delayed harvest on the behaviour of some sugar-beet varieties.**] *Publ. tech. Inst. belge Amélior. Better.* 1957, **25**, No. 2, 115–39, English and Flemish summaries.

Sugar-beet in Belgium is harvested in Oct.-Nov. In trials in 2 localities, 8 sugar-beet varieties were sown early (28 March and 3 Apr.) and late (11 and 20 Apr.), and harvested at 3 different dates from 25 Sept. to 4 Dec. Results showed that : (a) sowing early gave, on average, 602 kg. more sugar per ha. than sowing late ; (b) harvesting on 25 Sept. was too early ; (c) the sugar yield increased considerably during October but not during November ; (d) the polyploid varieties were suitable for an early harvest, and because of their high productivity were preferable to the varieties of type N ; (e) the varieties of type E, which have a long vegetative period, should be harvested late. —E.B.O.

1599 Simon, M. and others. L'intérêt des variétés polyploïdes de betterave sucrière. [**The advantages of polyploid varieties of sugar-beet.**] *Publ. Vulg. Inst. belge Amélior. Better.* 1957, No. 2, 13–25, illus.

In this publication for sugar-beet growers, the characteristics of polyploid varieties of sugar-beet are described. The high proportion of monogerm seed they contain is their principal advantage ; this feature facilitates thinning, if the seed is sown at the rate of 20 kg./ha. in well-prepared soil. Polyploid varieties are high-yielding, resistant to bolting and adapted to a wide range of lifting dates. It is pointed out, however, that their seed costs 50% more than that of other varieties.—E.B.O.

1600 Donà dalle Rose, A. Attività sperimentale della Stazione di Bieticoltura. 1955, 1956, 1957. [**Experimental work at the Station for Beet Cultivation. 1955-7.**] *Publ. 38, 46 and 52 Rovigo Sta. Sper. Bieticolt.* 1956, 1957 and 1958, pp. 64, 68 and 67, bibl. in text, illus. [Received March, 1958]

In varietal trials with sugar-beet, 3 selections of Maribo polyploid yielded best with 6779, 6756 and 6708 kg. of sugar per ha. ; the Klein types were resistant to *Cercospora beticola*, pp. 9–13.—E.B.O.

1601 Dyer, A. W. H. **Here they encourage the weeds to grow.** *Brit. Sug. Beet Rev.* 1958, **26**, No. 3, 123–5. [Wissington Sugar Factory]

A technique is described by which sugar-beet sown in early April on light, peat fen soil is protected from wind damage by weed growth between the rows, while the braird is kept free from weeds by cultivation and the use of pre-emergence weedkillers. Weed growth is cleared during June with a rotary hoe.—A.M.H.

1602 Holst, E. M. and others. **Chemical weed control in some Holly areas in Montana, Colorado, and Wyoming.** *J. Amer. Soc. Sug. Beet Technol.* 1957, **9**, No. 6, 499–502, bibl. 1. [Holly Sugar Corporation, Swink, Colorado]

The effectiveness of selective herbicides for controlling weeds in sugar-beet fields was investigated. DCU, TCA and propham, worked into the soil before seed was sown, gave some control of early grasses and broad-leaved weeds. Pre-emergence applications of sodium dalapon at 3 lb./ac. and post-emergence applications at 2·3–10·5 lb./ac. controlled *Avena fatua*, *Echinochloa crus-galli* and *Setaria* spp. Applications of more than 4·4 lb./ac. had a temporary adverse effect on beet plants in the 6- to 8-leaf stage. Pre-emergence applications of 2,4,5-TP at 6–12 lb./ac. controlled grasses and reduced broad-leaved weed populations by 40% ; post-emergence applications of 2–5 lb./ac. significantly controlled grasses, but tended to reduce beet sucrose. DCU at 14·6 lb./ac. significantly reduced grass weeds at Hardin, Montana, while DCU at 7 and 14 lb./ac. reduced broad-leaved weeds at Sheridan, Wyoming, without affecting grass weeds.—R.B.

1603 Lawlor, N. Jr. and others. **Results of seed treatment tests.** *J. Amer. Soc. Sug. Beet Technol.* 1957, **9**, No. 6, 529–35. [American Crystal Sugar Company, Clarksburg, California]

Field trials of sugar-beet seed treated with various fungicides were undertaken in 1954 and '55. The most successful treatments were orthocide at 8 and 12 oz./100 lb. of seed. Seeds treated with 0, 4, 6, 8, 10 and 12 oz. of orthocide or phygon per 100 lb. of seed were placed in storage for 20 months.

and samples were tested each month for percentage germination. Seeds from all treatments germinated satisfactorily after storage. There were no significant differences between treated seeds and controls. Field tests of the stored seed showed a significant difference between treatments in favour of orthocide.—R.B.

1604 JONES, F. G. W. **Sugar beet pests.** *Bull. 162 Minist. Agric. Fish., Fd, England and Wales* 1957, pp. vi + 63, illus., London: H.M.S.O., 6s. 6d. [Received April, 1958]

A guide for the recognition of sugar-beet pests is given. The effects of defoliation and loss of stand on yield are briefly considered. Individual pests, their life cycles, the types of injury they cause and methods for their control are described. —A.M.H.

1605 VAN STEYVOORT, L. La mouche de la betterave. [**The beet fly.**] *Publ. Vulg. Inst. belge Amélior. Better.* 1957, No. 1, 7–8.

Cultural and chemical measures are recommended for controlling the beet fly (*Pegomyia* sp.) on sugar-beet. Young plants should be sprayed with one of the following preparations at the minimum rate of 1 l. concentrated material per ha.: parathion, malathion, DDT or lindane in oil emulsion. Toxaphene, aldrin or dieldrin, all in oil emulsion, can also be used.—E.B.O.

1606 MINISTRY OF AGRICULTURE, FISHERIES AND FOOD. **Sugar beet yellows.** *Adv. Leafl. 323 Minist. Agric. Fish., Fd, England and Wales*, 1957, pp. 7, illus.

Control measures recommended are: prevention of infection from seed crops by growing these as far as possible from root crops: maintenance of healthy seed crops by growing in aphid-free areas; growing both seed- and root-crops in dense stands to reduce % infection; undersowing seed crops in barley in April to protect them from early infection; early sowing of root crops to avoid spring aphid migrations; spraying at regular intervals with systemic insecticides such as schradan and metasystox; clearance of sources of infection such as old mangel clamps and wild beets.—A.M.H.

1607 VAN STEYVOORT, L. La jaunisse de la betterave. [**Sugar-beet yellows.**] *Publ. Vulg. Inst. belge Amélior. Better.* 1957, No. 1, 5–6.

Measures are given for controlling sugar-beet yellows in Belgium. These include early sowing and a high plant density (75,000 plants per ha. at lifting). Fodder-beets kept in clamps after 1 Apr. are considered a main cause of the spread of the disease; these clamps should be emptied and their contents ploughed-under by this date. In the centres of production of sugar-beet seed, the aphid vector of the disease should be controlled by spraying with one of the following preparations: parathion; malathion; aldrin; dieldrin; a systemic insecticide [rates not given].—E.B.O.

1608 BLAESEN, P. and THIELEMANN, Rose. Zur Frage der Bekämpfung der Vergilbungskrankheit der Beta-Rüben durch Überträgerbekämpfung mit chemischen Mitteln. 2. Die Wirkung verschiedener Wirkstoffgruppen auf die Blattlauspopulation der Beta-Rüben. [**The control of sugar-beet yellows by controlling the vectors with chemical products. 2. The effect of different types of compound on the aphid population of sugar-beet.**] *Z. PflKrankh.* 1958, **65**, No. 3, 129–43, bibl. 13. [Biol. Bundesanst. f. Land- u. Forstwirtschaft, Inst. f. Hackfruchtbau, Elsdorf/Rhld, W. Germany]

In field experiments with sugar-beet, conducted from 1953 to 1956 in Nordrhein-Westfalen, the effectiveness of several compounds on aphids (*Myzus persicae* and *Doralis fabae*) was compared. Systemic and non-systemic compounds were used. The lay-out of the trials proved of great importance for testing sprays on aphids. The systemics, especially systox and metasystox, showed the best results of all the compounds used. Of the organic phosphorus compounds parathion and chlorthion were very much better than malathion and diazinon. The effect of all the chlorinated hydrocarbons was unsatisfactory. The influence of the sprays on alates was only small, but wingless individuals were effectively controlled. Differences in performance and effectiveness of different compounds and formulations are discussed. F.Eng. s.—D.B.

1609 PEARSON, J. **Two test cases.** *Fmr's Wkly, Lond.* 1958, **48**, No. 20, 15 (Suppl.), illus. [Brit. Sug. Corp., Ltd.]

In 1957 trials, spraying sugar-beet with systemic insecticides [not named] gave the following results: incidence of virus infection on 5 Sept. was 23% in plots sprayed on 3 June; 18% in plots sprayed on 18 June; 8% in plots sprayed on 3 and 18 June; and 64% in unsprayed plots. Double spraying increased yield by 2 tons 1 cwt./ac. and cash value by £14 6s./ac. compared with the control. A similar trial showed the following levels of virus infection on 10 Sept.: 20% in a plot sprayed on 28 May; 28% in a plot sprayed on 20 June; 10% in a plot sprayed on 28 May and 20 June; and 61% in an unsprayed plot. The nett increase in return from double spraying was £23 1s./ac.—A.M.H.

1610 LANDAU, N. **Vernalization effects in mangold and sugar-beet under thermal conditions unfavourable to flowering.** *Bull. Res. Coun. Israel* 1958, **6D**, No. 2, 127–8, bibl. 5.

In Israel, seed yields of beet are usually poor in seasons following a mild winter. Experiments were designed to ascertain whether bolting can be

promoted by seed vernalization when subsequent development takes place under high temperature and a favourable photoperiod. Under conditions of the test, bolting was induced in some varieties (notably Pedigree) by subjecting the seed to low temperature (2·5°C.) for a prolonged time (4·5 months).—M.H.

1611 Gaskill, J. O. **A preliminary report on the use of gibberellic acid to hasten reproductive development in sugar beet seedlings.** *J. Amer. Soc. Sug. Beet Technol.* 1957, **9**, No. 6, 521–8, bibl. 7, illus. [Colorado Agric. Exp. Sta., Fort Collins]

The bolting-resistant sugar-beet strain NB1 flowered after a treatment of 43 days' photothermal induction followed by 4 foliar applications of GA in 1000 ppm. aqueous solution. Eleven out of 12 plants set mature viable seed within 25 weeks of sowing. Control plants without GA or without photothermal induction did not flower within this period. F.S.—R.B.

1612 van Ginneken, P. J. H. De minerale samenstelling van loof en wortel van suikerbieten gedurende de groei. 2. **The mineral composition of sugar-beet tops and roots during the growing period. 2.** *Meded. Inst. rat. Suikerprod.* 1956, **26**, No. 4, 131–225, English and French summaries.

Weekly determinations of the composition of the tops and roots of sugar-beet with special reference to N, P, K, Na, Mg, Ca and sugar were made on crops grown at Zevenbergen and Halsteren in 1942. Relationships between mineral composition and weights of tops and roots, described and illustrated by graphs, were compared with similar data from a crop grown at Zevenbergen in 1943. [See *Fld Crop Abstr.* 6 : 634.] The sugar-producing capacity per unit weight of foliage (in terms of sugar stored) increased with time until the mineral-content of the whole plant was almost at a maximum. In crops grown in 1942 at Halsteren and in 1943 at Zevenbergen, there was a correlation between the quantity of mineral substances at maximum weight of tops and the final yield of roots, but not in the 1942 crop at Zevenbergen. F.S.—R.B.

1613 Martin, L. and others. Étude biomètrique du bilan ionique de la betterave sucrière en aquiculture. [**Biometrical study on the ionic balance of sugar-beet in water culture.**] *Publ. tech. Inst. belge Amélior. Better.* 1957, **25**, No. 2, 59–67, bibl. 2, English and Flemish summaries.

1614 Laloux, R. Essais de fumure au moyen de divers types d'engrais sur betteraves sucrières. [**Manurial trials with various types of fertilizers applied to sugar-beet.**] *Bull. Inst. agron., Gembl.* 1957, **25**, No. 3–4, 339–52, bibl. 16.

The results from 4 years' trials on fertile soil indicated that the optimal N manuring for sugar-beet was 125–150 kg. of N/ha. (applied in addition to 40 tons of f.y.m. per ha.). In these trials the best amount of K fertilizer was about 225 kg. of K_2O/ha.—E.B.O.

1615 Gross, F. Untersuchungen über den Einfluss von Schafpferch- und Stallmistdüngung auf den Rüben- und Blattertrag und den Zuckergehalt von Zuckerrüben bei verschieden hohen Stickstoffgaben. [**Beet- and leaf-yield and the sugar content of sugar-beet as affected by sheep-folding and the application of farmyard manure together with varying amounts of nitrogenous fertilizer.**] *Mitt. bayer. Landesanst. Tierzucht Grub* 1957, **5**, No. 5/6, 151–62, bibl. 12.

In a replicated trial on heavy loam soil, sugar-beet in all the plots received 240 kg. K_2O and 100 kg. P_2O_5 per ha. ; 4 series received the following quantities of N per ha., 0, 80, 130 and 180 kg. ; and in addition 3 series received, respectively, 16 hours' sheep-folding at the rate of 1 sheep per 1·3 sq. m., no organic manure, and 30,000 kg. f.y.m. per ha. Sheep-folding resulted in beet yields which could not be much improved by applying additional N although the nitrogenous fertilizer increased leaf yield. When f.y.m. was used, at least 80 kg. N per ha. was necessary for obtaining maximum beet yields, but even 180 kg. N per ha. was by no means sufficient to ensure maximum leaf yields. Without organic manure 130 kg. N per ha. were necessary for maximum beet yields ; when f.y.m. was used, 80 kg. N were sufficient ; but with sheep-folding, no N was requisite. For leaf yield, however, with or without organic manure, up to 180 kg. N per ha. were well utilized. Sugar content can be reduced by manuring. The highest sugar yields are obtained, therefore, from moderate manuring rates. These were found in the sheep-folding series without N ; but, without organic manure, 130 kg. N per ha. were found necessary.—G.M.R.

1616 Rothamsted Experimental Station. **Sugar-beet.** *Rep. Rothamsted Exp. Sta.* 1957, Harpenden, 1958, pp. 316, 1 map.

1. Effect of mineral nutrients on leaf growth, pp. 86–7. P increased leaf area, the effect being maximal about 6 weeks after germination ; it also increased the rate of leaf production throughout the growing period, increased the size of the first 10 leaves and decreased that of subsequent ones. N had no effect on leaf area up to 6 weeks and a maximum effect after 12 weeks ; it increased the rate of leaf production, after the first 2 months, increased the longevity of the first 6 leaves, but decreased that of later ones and consistently increased leaf size, with a maximum effect on leaves

10–20. The effect of K on leaf area was less than that of N and P, but was at a maximum at about 12 weeks. It had no effect on the rate of leaf production and only slight effects on longevity of leaves, and caused a small increase in the size of the first 15 leaves.

2. Interdependence of leaves, pp. 87–8. Removing leaves 1–5 increased the size of leaf 6, when the nutrient supply was low, and decreased it when the nutrient supply was high. Removal of leaves 3–5 had a similar but smaller effect and growth of subsequent leaves was similarly affected. Removal of leaves 7–11 increased the size of leaf 6 and of subsequent leaves. When all leaves after the 6th were removed, the first 6 grew larger, lived longer and continued to expand for longer.

3. Effect on plant growth of varying soil moisture deficit, pp. 89–90. Sugar-beet was grown in small field plots protected from rain by Dutch lights. Treatments were : (a) soil-water content maintained near field capacity by frequent watering (total of 5·4 in. applied) ; (b) soil-water content to a depth of 12 in. allowed to fall to 13% in July, when 1 in. of water was applied, after which the water content was allowed to fall to 14% in August ; (c) 5 waterings totalling 1 in., in July-August (water content 12–20%). Treatment (a) yielded over 6 tons dry matter/ac. by late August. Yields of (b) and (c) were about 80% of (a).

4. Virus yellows, pp. 111–13. Elimination of wild beet to control yellows. An MCPA-type weedkiller effectively controlled established plants, but did not prevent seedling regrowth. Control of aphid vectors. Where incidence of yellows in unsprayed crops exceeded 90%, spraying twice with metasystox increased yields by up to 4·5 tons of roots/ac., increased sugar content by 1% and improved juice purity. Resistant lines of sugar-beet were tested near Ipswich, where yellows was severe. A7S/1 outyielded Sharpes E and Battles E in sugar per ac. by 13% and 27%, respectively. Q1S/1 outyielded them by 16% and 30%, respectively.

5. Seed dressings, p. 122. Seed steeped in ethyl mercury phosphate solution [concentration not given] gave 10% more seedlings than seed treated with dry organo-mercury dressings. [See also Abs. 1843.]—A.M.H.

FODDER-BEET AND MANGELS

See also Abs. 1723

1617 Willey, L. A. **Mangel and fodder beet trials, 1947-1950.** *J. nat. Inst. agric. Bot.* 1957, **8**, No. 1, 106–15, bibl. 1.

Trials were conducted at 9–10 centres to compare Danish fodder sugar-beet and Barres mangels with English mangels and half-sugar mangels. Hunsballe IX and X gave the highest dry-matter yields, but harvesting difficulties are against their widespread use. Barres Øtofte IX and X combined the desirable field characters of the English mangel with superior dry-matter yield and keeping quality. F.S.—A.M.H.

1618 Knight, R. L. **Fodder beet and high dry-matter mangel trials 1952-1954.** *J. nat. Inst. agric. Bot.* 1957, **8**, No. 1, 116–34, bibl. 1.

65 trials of fodder-beet and high dry-matter mangels during 1952–4 are reported. Grown as 3 separate series, the trials included (a) Hunsballe X (control), Brabant Half Sugar, Hinderupgaard X, Pajbjerg X, Pajbjerg Rex X, and Klein E sugar-beet ; (b) Red Øtofte X (control), Triumf, White Tystofte X, Yellow Øtofte X and Yellow Dæno XI ; (c) Barres Øtofte X (control), Barres CB, Øtofte Nova X, Regia and White Chief. For each series full details of root numbers and yields of dry-matter and tops are given, with mean results for yields of clean roots, dirt tares, dry-matter content, % bolters and field characters, such as ease of lifting, depth of root in soil, fanging and keeping quality in the clamp. F.S.—A.M.H.

1619 Manner, R. Jämförelse mellan sockerbeta och fodersockerbeta åren 1950–56. **Comparison between sugar-beet and fodder sugar-beet 1950-56.** *Medd. 14 Gullåk. Växtförädl-Anst.* 1957, 15–24, bibl. 7, English summary.

In 9 trials during 1950–6 at Gullåker, Sweden, mean yields per ha. of the sugar-beet variety Hilleshög and the fodder-beet variety Gullåker were 511·3 and 615·8 deciton roots, 118·7 and 120·3 dt. dry matter, 316·9 and 343·2 dt. tops (6 trials) and 98·2 and 100·4 dt. sugar, respectively; mean contents of dry matter in the roots were 23·2 and 19·5% and mean sugar contents were 18·3 and 15·3%. Data are given showing the proportion of sugar in the dry matter of fodder-beet and sugar-beet roots differing widely in dry-matter content. There was some evidence that low dry-matter contents (below about 20%) were associated with low contents of sugar in the dry matter, though exceptions were noted. Data are also given of different agronomic characters of the varieties tested, together with observations on their respective merits for different agronomic purposes.—P.J.B.

TURNIPS

1620 Maddox, J. M. **Precision seeding the turnip crop.** *Scot. Agric.* 1958, **37**, No. 4, 181–4, bibl. 2, illus. [North Scotland Coll. Agric.]

The advantages and economic aspects of precision seeding of turnips are discussed. The need for correctly sized seed is emphasized. Spacings of 2, 3 and 4 in. proved satisfactory and gave almost the same yields per acre as barrow-sown crops. On clean land it was practical to use 6- or 8-in. spacings and to omit singling.—A.M.H.

1621 Opsahl, B. Forsøk med sorter og stammer av nepe 1953–56. **Trials with different**

varieties and strains of turnip. *Forskn. Fors. Landbr.* 1957, **8**, No. 6, 433–46, bibl., English summary.

The results are given of 43 trials at 12 locations in Norway with 12 varieties of turnips. Mean yields of root dry matter for Roskilde Østersundom and Roskilde Yellow Tankard IX were 624 and 616 kg./decare, respectively, and were significantly higher than the yields of the other varieties, except for Roskilde Majturnips [May turnip] B and Hinderupgaard Yellow Tankard IX, with 603 and 608 kg./decare, respectively. Combined yields of root dry matter + 60% of the leaf dry matter were headed by Roskilde Yellow Tankard IX, with 771 kg., followed by Roskilde Høstturnips [Autumn turnip] VII, Hinderupgaard Yellow Tankard IX, Svalöf Sirius, Roskilde Østersundom and Roskilde Majturnips B, all of which yielded between 730 and 750 kg./decare. Dry-matter contents of the roots were highest for Forus Kvit Mai and Roskilde Majturnips B, with 12·8, 12·3%, respectively. The dry-matter contents of the other varieties ranged from 8·8 to 10·9%. The dry-matter content of the leaves was positively correlated ($r = 0{\cdot}71$) with that of the roots, though there was not a great deal of difference between varieties in this respect. The high dry-matter content varieties Forus Kvit Mai and Roskilde Majturnips B had respective average incidences of 2·2 and 1·4% of roots with symptoms of club root [*Plasmodiophora brassicae*] ; Roskilde Høstturnips VII, Weibulls Immuna II and Weibulls Immuna III were also very resistant. The other varieties had incidences ranging from 15 to 26%, with Roskilde Østersundom the most heavily infected. Data are given of the yields of varieties in the 6 major regions of Norway and of varieties recommended for growing in these regions.—P.J.B.

1622 Opsahl, B. Forsøk med stammer av kålrot 1953–1956. **Strain trials with swedes 1953–1956.** *Forskn. Fors. Landbr.* 1958, **9**, No. 1, 1–16, bibl. 3, English summary.

In regional trials at 9 locations in Norway, 25 varieties of swedes were compared in 36 trials. From the mean yields of dry matter in the roots, 3 main groups of varieties were distinguished. The first contained those which yielded more than 790 kg. dry matter/decare and included the Bangholm strains Wilby Øtofte XI, Øtofte XI, Hinderupgaard XI, Pajbjerg XI, Pajbjerg Sahna XI, Olsgård, Gokstad and Hellerud, the Wilhelmsburger varieties Reform XI and Hunsballe and the variety Vidarshov Gro. The second group, which included those with yields of about 780 kg. dry matter/decare, included the Rekord varieties Taastrupgaard XI and Taastrupgaard and the Wilhelmsburger variety Øtofte XI and F. Group 3, with dry-matter yields less than 760 kg./decare, included the Wilhelmsburger varieties Trifolium XI and Hellerud. The dry-matter yields of the tops averaged 2226 and 2217 kg./decare for the Bangholm varieties Pajbjerg XI and Pajbjerg Sahna XI, respectively, followed by 2096 kg. for Wilby Øtofte XI. The average dry-matter content of the roots ranged from 10·8 to 12·9 but was in most cases, between 11 and 12%. The incidence of club root [*Plasmodiophora brassicae*] was lowest for the Wilhelmsburger variety Øtofte XI and F and for Vidarshov Gro (4·9–6·4%) and highest for the Bangholm varieties Hinderupgaard XI, Olsgård, Wilby Øtofte XI and Gokstad (15·3–18·8%). The Bangholm varieties and Vidarshov Gro appeared to require better growing conditions than the other varieties. There was a highly significant negative correlation between ascorbic-acid content and root dry-matter yields.—P.J.B.

POTATOES

See also Abs. 1791, 1792, 1795, 1800, 1834, 1844, 1850, 1852, 1854, 1855

1623 Statens Forsøgsvirksomhed i Plantekultur. Denmark. Forsøg med raekke- og planteafstand for kartofler 1953–57. [**Trials on plant spacing for potatoes, 1953-7.**] *Medd. 599 Stat. Forsøgsvirk. Plantekult.* 1958, pp. 4.

The trials reported were carried out at 4 locations in Denmark, all on sandy loam soil. Varieties used were Bintje and Dianella and plant spacings (cm.) were : (a) 63 × 40, (b) 63 × 20, (c) 74 × 17, (d) 74 × 34 and (e) 84 × 20, to give plant populations of 40, 79, 80, 40 and 60 thousand/ha., respectively. Mean tuber yields of Bintje for spacings (a), (b), (c), (d), and (e) were 233, 227, 214, 227 and 219 hkg./ha., respectively ; with Dianella, tuber yields averaged 281, 261, 252, 281 and 255 hkg./ha. Plant spacings (b) and (c) resulted in the highest proportion of seed-size tubers, and were followed by (e). Spacings (a) and (d) resulted in yields containing similar proportions of tubers of different sizes and a considerable increase in the proportion of tubers greater than 55 mm. diameter, compared with the other treatments. Distance between plants in the row had much greater effect on the proportions of tubers of different sizes than did the distance between rows. It was concluded that greater distances between rows than the normal 63 cm. can be used without entailing great yield reductions, though plant populations per unit area must be held constant. Plant populations greater than 40,000/ha. resulted in decreases in net tuber yields ; the proportion of small tubers increased (which may interest seed producers) but the advantages, in most cases, did not outweigh the additional expenditure on seed tubers.—P.J.B.

1624 Haugdal, S. Forsøk med små settepoteter satt enkeltvis og i grupper med ulik avstand, og forsøk med like mengder utsæd av ulike settepotetstørrelser. **Experiments with small seed**

potatoes planted single and in groups with varied spacing of sets, and experiments with identical rates of seed potatoes of different tuber size. *Forskn. Fors. Landbr.* 1957, **8**, No. 6, 405–16, bibl. 6, English summary. [State Exp. Sta., Holt, Tromsø, Norway]

The trials reported were carried out at Holt, near Tromsø, in N. Norway, using the variety Gullauge. In the first series of trials in 1941–4, seed potatoes averaging 18·5 g. were planted singly, or in groups of 2 or 3, in rows 60 cm. apart, with 15 or 30 cm. between hills in the row. Tuber yields increased from 1453 kg. per decare for seed planted singly at a 30-cm. spacing, to 2117 kg. for seed planted in groups of 3 with 15-cm. spacing ; respective yields of ware (over 35 mm. diameter) tubers were 1260 and 1554 kg. In a second series of trials in 1945–9, seed potatoes averaging 19 g. were planted individually with a spacing of 5, 7·5 or 10 cm. in the row, or in groups of two, spaced 15 cm. apart, or groups of 3 spaced 30 cm. apart. Spacing individual tubers 5, 7·5, 10, 15 and 30 cm. apart in the row resulted in total average tuber yields of 2661, 2599, 2450, 2380 and 2109 kg./decare and yields of ware tubers of 1996, 2092, 2045, 2065 and 1906 kg./decare, respectively. Total tuber yields where two seed tubers were sown in hills 15 and 30 cm. apart averaged 2586 and 2369 kg. and where three were sown in hills 15 and 30 cm. apart, 2634 and 2437 kg./decare, respectively ; highest yields of ware tubers (2108 kg.) resulted from planting in groups of two, 15 cm. apart. In a third series of trials in 1945–9, seed tubers weighing an average of 10, 20 and 50 g. were planted individually at respective spacings in the rows of 5, 10 and 25 cm., so that the weight of tubers planted in all cases was 333 kg. per decare. Mean tuber yields where row spacings of 5, 10 and 25 cm. were used were 2384, 2321 and 2171 kg./decare respectively ; mean yields of ware tubers were 1830, 1891 and 1851 kg. These results showed that where the same weights of seed tubers were planted per decare, planting single tubers, or groups of tubers with correspondingly larger spacings between hills, resulted in substantially similar yields of tubers and dry matter, dry-matter contents of the tubers, and percentages of small and large tubers. Increasing the number of seed tubers planted resulted in the same yield increases as had previously been obtained by increasing the size of seed tubers, i.e., total tuber- and dry-matter yields increased, though the proportion of large tubers in the yield decreased. Where the weight of seed tubers planted per decare was held constant, the smallest tubers resulted in the greatest tuber yields and the smallest mean weight per tuber.—P.J.B.

1625 Boogaard, E. W. Het voorbehandelen en poten van aardappelen in de Veenkoloniën. [**Pretreatment and planting of potatoes in the reclaimed fenlands.**] *LandbMechanisatie* 1958, **9**, No. 3, 139–43.

Potatoes (var. Voran) (a) without sprouts, (b) with sprouts just showing, (c) with sprouts 1 cm. long developed in artificial light, (d) with sprouts 1 cm. long developed in daylight (e) with sprouts 3 cm. long developed in artificial light, were planted by (1) throwing into holes made with a hoe, then earthing over, (2) placing in previously made holes, or (3) planted and earthed over with an automatic potato-planter. The sprouts of many of the tubers remaining in the machine after planting were damaged. After about a week, new sprouts formed on those damaged. Despite the initial sprout damage caused by the machine, the plants in groups 3 appeared above ground about the same time as those in groups 1 and 2, and the number of stems produced per tuber was greater with treatments 3c, 3d and 3e than with other treatments. The highest yields (43,170 kg./ha.) were obtained with (c) treatments. There was no significant relationship between yield and planting method.—R.B.

1626 Royston, R. and others. **Potatoes and sweetpotatoes : usual dates for planting, harvesting and marketing, by seasons, in principal areas.** *Agric. Handbk 127*, Agric. Mkt. Serv., U.S. Dep. Agric. 1957, pp. 16, illus.

1627 Rinno, G. Der Anbau von Winterzwischenfrüchten in seiner Auswirkung auf die Wasserversorgung und den Ertrag von Kartoffeln. [**The effect of the cultivation of winter catch-crops on the soil-water supply available for potatoes and its influence on yield.**] *Z. Acker- u. PflBau* 1958, **105**, No. 3, 289–300, bibl. 13, English summary. [Inst. zur Steigerung der Pflanzenerträge, Paulinenaue, E. Germany]

Experiments were conducted to investigate whether the cultivation of leguminous catch crops reduced the soil-water supply for the main crop (potatoes) and if so, whether the loss of water counteracted the beneficial effects of a legume crop and reduced yields of the main crop. In the environment of this experiment, with medium rainfall (40-yr. average of 544 mm.) and an alluvial sandy, humus soil, the potato yield after winter catch-crops was not lower than after fallow.—D.B.

1628 Manner, R. Förgröningsförsök med potatis i varmbänk åren 1953–55. **On the treatment of seed potatoes before planting in hot beds in the years 1953-5.** *Medd. 14 Gullåk. VäxtförädlAnst.* 1957, 25–8, English summary.

The trials reported were carried out at the Gullåker Plant Breeding Institute, Sweden. Potatoes (var. Privera) were sprouted in : (a) peat litter, (b) a cold greenhouse (10°C.), (c) a warm greenhouse (20°C.), or were left unsprouted, before being planted in hot-beds under frames during

23 March to 18 April. Yields per frame (2·05 m.²) for treatments (a), (b) and (c) at the first harvest in early June averaged 2·1, 1·71 and 1·41 kg. tubers, compared with 0·91 kg. for unsprouted tubers. Yields at the second harvest in mid-June followed similar trends and were highest for (a), with 2·56 kg. tubers. In these trials, it was possible to secure early potatoes 2–4 weeks before the normal date. In a trial in 1954, potatoes were sprouted as above, but were planted in the field. Sprouting resulted in yields ranging from 7765 to 8940 kg./ha., compared with 3060 kg. for unsprouted tubers. Because all foliage severely frosted at the end of May, there were no great differences between sprouting treatments in terms of yield.—P.J.B.

1629 Bonvicini, M. Patate da seme 1957. [**Seed potatoes 1957**]. *Sementi elette* 1958, **4**, No. 2, 45–50, bibl. 1, illus., English and German summaries. [Ist. Allev. Veg., Bologna, Italy]

Information is given on the production (varieties, crop areas and yields) of seed potatoes in Italy in 1957 in the multiplication centres authorized by the Ministry of Agriculture.—E.B.O.

1630 Schepers, A. Enige resultaten van het onderzoek naar het doodspuiten van aardappelen. [**Some results of experiments in killing potato leaves by spraying.**] *Rep. Exp. Fm "De Bouwing", Randwijk* [n.d.], 74–7. [Rec. 1958]

The efficacy of applying 60 l. DNC in oil in 500 l. water per ha. was tested for 2 very early, 4 medium-early and 4 late potato varieties. Results are tabulated. One application sufficed to kill the very early varieties ; the others required one or two more applications of the spray. With the variety Red Star, increasing the quantity of DNC from 40 l. to 80 l. per ha. not only greatly increased the damage to surface runners but also reduced the number of underground shoots formed. Spraying twice with 40 l. DNC in oil, with an interval of 1 hr. between, had the same effect as spraying once with 80 l.—G.M.R.

1631 Höppner, E. Die neuen Kartoffelsorten des Jahres 1958. [**New varieties of potato in 1958.**] *Kartoffelbau* 1958, **9**, No. 6, 107.

The following varieties, in addition to the export variety Fecula, were recognized in 1958 : very early, Imme ; early, Gallo ; medium-early, Andrea, Climax and Feldeslohn (culinary), Petra (culinary and industrial) ; medium-late to late, Servena and Isola (culinary), Condea, Hassia and Inka (culinary and industrial), Erdkraft and Rosa (industrial). A description of each variety is given in tabulated data.—D.B.

1632 Thran, P. Wetter und Stärkegehalt. [**Weather and starch content.**] *Stärkekartoffel* 1958, **3**, No 3, 2–4. [Weather Bureau, Schleswig, W. Germany]

The response of potato varieties to weather conditions was studied. The optimal temperature and rainfall in June, July, August and September for highest starch-content in each of 7 varieties are tabulated. These optima are compared with the average temperature and rainfall at Hamburg in these months, and with the optimal temperature and rainfall needed for the highest tuber yield. At the same time, the degree of sensitivity of each potato variety to deviation from the optimal conditions is estimated. The varieties fall into two groups, namely, Type 1, those which have a high percentage starch-content but are unfortunately very sensitive to unfavourable weather conditions, and Type 2, which have not so high a starch content but are less dependent upon temperature and rainfall, and, under poor climatic conditions, can produce even more starch than the Type 1 varieties. There do not appear to be any transitional forms between these types, and it is probable that Type 2 varieties, which are also prolific tuber-bearers, represent long-day forms and the Type 1 varieties, with their more moderate tuber crops, represent short-day forms. The latter are very sensitive to climatic conditions, especially evaporation in September. Climatic studies of this nature enable the grower to select varieties which respond to his own regional climate. For Schleswig-Holstein, climatic maps are available for this purpose. Some conclusions of importance for the breeder are deduced.—G.M.R.

1633 Statens Forsøgsvirksomhed i Plantekultur, Denmark. Forsøg med middeltidlige kartoffelsorter, 1955–57. [**Trials with medium-early potato varieties, 1955-7.**] *Medd. 603 Stat. Forsøgsvirk. Plantekult.* 1958, pp. 4.

The trials reported were carried out at one location on light clay soil and at 4 locations on sandy soil. In 14 trials during 1955–7, total tuber yields of Bintje, Sieglinde, Belle de Locronan, Tylstrup 48287, Tylstrup 48321 and Urgenta averaged 267, 220, 308, 283, 274, and 270 hkg./ha., with 20, 12, 21, 36, 35 and 44% of tubers over 50 mm. in diameter, respectively. In 10 trials during 1955–6, average total tuber yields of Bintje and Tylstrup 48426 were 236 and 264 hkg./ha., respectively, while in 9 trials during 1956–7, tuber yields of Bintje and Kennebec averaged 289 and 270 hkg./ha. Sieglinde was a little earlier-maturing than Bintje, which was followed, in order, by Urgenta and Kennebec ; the Tylstrup varieties and Belle de Locronan matured about 14 days later than Bintje. Sieglinde and Bintje showed greatest, and Tylstrup 48287 least, susceptibility to blight [*Phytophthora infestans*]. Bintje had the best culinary quality. Brief notes are given on each variety.—P.J.B.

1634 Van der Plank, J. E. **New potato variety BP. 1.** *S. Afr. J. agric. Sci.* 1958, **1**,

No. 1, 107–8. [Div. Pl. Path., Pretoria]

Information is given on the characteristics, disease resistance, cooking quality and suitability for different areas in South Africa of the new variety BP. 1, which was tried under the number 479/18.—A.M.H.

1635 Höppner, E. and Geidel, H. Krautfäuleanfälligkeit unserer Kartoffelsorten. [**Susceptibility of German potato varieties to potato leaf-rot (*Phytophthora infestans*).**] *Kartoffelbau* 1958, **9**, No. 5, 82–4. [Rethmar]

1636 Uhlig, —. Die meteorologischen Voraussetzungen für die Ausbreitung der Kartoffelkrautfäule. [**Meteorological conditions for the spreading of potato leaf-rot (*Phytophthora infestans*).**] *Kartoffelbau* 1958, **9**, No. 5, 86. [Weather Bureau, Bremen]

1637 Førsund, E. Tørråte på poteter og tomater. [**Blight on potatoes and tomatoes.**] *Norsk Landbr.* 1958, **77**, No. 14, 326–7 and 331, illus.

Practical recommendations are given for the control of blight [*Phytophthora infestans*] and a table gives details of the resistance of the haulms and tubers of 27 varieties of potato grown in Norway.—P.J.B.

1638 Giardini, A. and Antonelli, C. Prove di lotta contro la cercospora nel 1956. [**Trials to control *Cercospora beticola* in 1956 (in Italy).**] *Industr. saccar. ital.* 1957, **50**, No. 5–6, 109–20, bibl. 6.

An account is given of trials to test 12 fungicidal preparations, 7 of which contained Cu, for controlling *Cercospora beticola* on sugar-beet in Rovigo province, where attacks of this disease are serious. Results showed that all the Cu preparations, 2 thiocarbamate- and 2 mixed Cu/thiocarbamate-preparations were effective and resulted in significant increases in yield over the controls. TMTD was less effective than the other preparations tested. Success with these treatments is dependent on the number of applications given (which should be 2 or 3 according to the time of harvesting) and, in the case of Cu preparations, not on the amount of Cu given in each application, provided that not less than 2 kg. of Cu are applied per ha. in each treatment. Although the greatest advantages were obtained from susceptible varieties, resistant varieties also benefited from these treatments.—E.B.O.

1639 ten Boer, H. Het Rizoctoniaprobleem in Groningen. [**The *Rhizoctonia* problem in Groningen.**] *LandbVoorl.* 1958, **15**, No. 2, 70–3, illus. [Rijkslandbconsulentschap N.-Groningen]

Seed potatoes either infected with *Rhizoctonia solani*, or uninfected were prepared in 3 groups : (a) untreated ; (b) disinfected for 2 min. ; (c) disinfected for 20 min. [treatments not specified]. Presprouted seed was planted on 9 and 10 April in infected and uninfected land and the crop was harvested on 6 September. Yields from clean seed were not influenced by the use of disinfectants. The crop from contaminated seed was heavily infected, irrespective of treatment or soil used ; treatments (b) and (c) resulted in increased yields, treatment (c) giving the highest yields. The proportion of infected tubers harvested was not greatly affected by disinfection. Tubers from uncontaminated seed on infected land were nearly all uninfected. The majority of tubers yielded by uninfected seed were between 35–45 mm. in length, while most tubers yielded by infected seed were over 45 mm. in length. Double disinfection of the seed had little effect on the crop.—R.B.

1640 Countryman, Nicosia. **The potato tuber moth (*Gnorimoschema (Phthorimaea) operculella*, Zell).** *Countryman, Nicosia* 1958, Apr., 26–7.

Control measures, including the use of DDT, are given.—E.B.O.

1641 Maclachlan, D. S. and Sutton, M. D. **The use of antibiotics in the control of potato ring rot.** *Rep. Quebec Soc. Protect. Pl.* 1956, **38**, 76–82, bibl. 5. [Bot. Pl. Path. Lab., Canada Dep. Agric., Ottawa, Ontario]

Cut setts of Green Mountain potatoes were inoculated with *Corynebacterium sepedonicum* and then soaked in solutions of 6 antibiotics. After drying for a few hours, the setts were planted in the field. Examination of the harvested crop showed that terramycin was the most effective in controlling the disease. Actively growing potato plants in a greenhouse were able to absorb terramycin through the roots ; it was translocated to the top of the plant within 24 hr., and its concentration there reached a maximum within 48 hr. It was also shown that terramycin could be translocated downwards.—R.B.

1642 Zingstra, H. 10-jarige kiemproef met aardappelzaden. [**A ten-year germination trial with potato seed.**] *Meded. N.A.K.*, 1958, **14**, No. 10, 115. [Comm. Bevord. Kweken en Onderz. Nieuwe Aardappelrassen, Wageningen]

In 1947, potato seed from a cross between the varieties Noordeling and Libertas was harvested and stored dry at room temperature in 10 packets of 250. Each March, seeds were tested for germination characteristics. The percentage of seed which had germinated within 7 days was taken to be the energy of germination, and the percentage germinating within 21 days was regarded as the germinating capacity. The germinating capacity was high during the first 7 years, but afterwards deteriorated rapidly to about 25% after 10 years. During the first year after harvest it was 90%.

Seed 2–3 years old germinated best (97%). The energy of germination was good during the first 5 years, and then deteriorated rapidly down to zero after 10 years. Older seed germinated more slowly. Samples of seed from a cross made in 1948 between the same varieties were tested in 1955, when they were 6 years old. Germination was 87% in a laboratory test at Wageningen, and 60% in soil in a greenhouse at Marknesse (Noordoostpolder). The energy of germination was 83% at Wageningen and only 21·2% at Marknesse. It was concluded that in practice it was advisable to sow seed 2 or 3 years after harvesting.—R.B.

1643 CHAPMAN, H. W. **Tuberization in the potato plant.** *Physiol. Plant.* 1958, **11**, No. 2, 215–24, bibl. 14, illus. [Colorado State Univ., Fort Collins]

Potato (var. Triumph) seed-pieces were sprouted and then grown in nutrient solutions under : (a) 9-hr. photoperiods, followed by a 15-hr. dark period, (b) an 18-hr. photoperiod, followed by a 6-hr. dark period and (c) continuous light. In further experiments, leafy tops, 30–60 cm. long taken from tuber-induced plants grown under 9-hr. photoperiods, or non-induced plants, were cleft-grafted to stocks of both tuber-induced and non-induced plants. In a third series of trials, cuttings were taken from the upper one-third, the middle one-third, or from the basal portions of the stems and were either placed in rooting media after leaf removal, or excised individual nodes were cultured on sterile media. Under short-day conditions, plants rapidly formed a relatively small number of tubers on short stolons ; when tubers were formed, the vegetative development of both roots and shoots ceased. Long-day conditions (18 hr., or continuous light) resulted in the development of very long, branched stolons, an extensive root system, a high rate of vegetative growth of tops and extensive tuber growth 3–5 weeks after the plants grown under short-day conditions had formed tubers. Treatment of the terminal leaf-cluster, only, with either long- or short-day photoperiods resulted in tuber development similar to that where the entire plant was subjected to treatment. Plants subjected to 7 days of short-day photoperiods failed to form tubers consistently ; 14 days' treatment resulted in consistent tuber formation. Where plant tops were excised so as to cause two equal shoots to develop, subjecting one shoot to short-day and the other to long-day treatment resulted in unilateral tuber production on that side of the plant served by the shoot subjected to short-day photoperiod ; the tuber-inducing stimulus diffused only slowly to the other side of the plant. The tuber-forming stimulus was able to pass a graft union. Grafting short-day, tuber-induced stocks to long-day, non-induced scions resulted in the resumption of vegetative growth of the stocks and stolon production from the tuber eyes. Nodes from stems taken from tuber-induced plants developed tubers at the axillary buds ; nodes from non-induced plants produced axillary shoots. The tubers formed at the axils commonly produced vegetative shoots from the eyes at a later stage, showing that the tuber-inducing stimulus was later lost. The nature of the tuber-inducing stimulus is discussed. It was thought to be produced largely by active, above-ground, growing points and its movement was basipetal, with little or no lateral movement. The stimulus is present in all parts of the plant.—P.J.B.

1644 SCHULZE, E. Zusammenwirken von Tageslänge und Höhe der Stickstoffgabe bei Kulturkartoffeln. [**The combined effect of photoperiod and the level of applied nitrogen on potatoes.**] *Z. Acker- u. PflBau* 1958, **105**, No. 3, 258–70, bibl. 4, illus., English summary.

The experiments described in *Fld Crop Abstr.* 8 : 943 and 10 : 199 were continued, using the variety Bona planted 5 May and Erstling planted 19 July. They were grown under 12-, 18- and 24-hr. photoperiods, with 1-, 2-, 3- and 4-(for Erstling) g. N per pot. The longer the photoperiod and the higher the level of applied N the later was the onset of tuber formation, the lower was the tuber yield and the greater was the quantity of haulm at the final harvest. Under 12-hr. day, increased assimilation (helped by increased N applications) resulted in increased tuber formation ; under 18- and 24-hr. day it resulted in increased production of haulms. The beginning of tuber formation did not necessarily coincide with the beginning of flowering. Plants growing under a 12-hr. day, which did not flower, began tuber formation shortly after plant emergence. The longer the photoperiod, and the greater the quantity of N applied, the longer were the tuber-bearing stolons, the greater were the number and length of the haulm-bearing stolons, and the greater was the quantity of roots. The haulm-bearing stolons, produced under an 18- and a 24-hr. day were able to flower, while those stolons which remained underground often produced chains of tubers. Despite the fact that plants grown under long-days showed greater resistance to blight (*Phytophthora* [*infestans*] and *Alternaria* [*solani*]) the plants grown under a short-day have given consistently, since 1953, higher tuber-yields than those under long-day conditions.—D.B.

1645 KUSHIZAKI, M. **Nutrio-physiological study of potato plants. 1. Absorption and translocation of inorganic elements by potato plants.** [Japanese] *Res. Bull. Hokkaido Nat. Agric. Exp. Sta.* 1957, No. 72, 72–81, English summary.

The distribution of N, P, K and Ca in leaves (including petioles), stalks and tubers throughout the growth of the potato plant (Irish Cobbler) was

studied by sampling and chemically analysing these plant organs at 9 growth stages. These stages were (days after planting in brackets) : just before emergence (28), just after emergence (35), development of primary leaves (43), beginning of budding (52), flowering (67), 10 days after flowering ceased (89), yellowing of leaves (105), leaves dead (117), stalks as well as leaves dead (124). At the leaf-yellowing stage the tuber contained (as % of plant totals) : dry matter, 81 ; N, 65 ; P, 85 ; K, 75 ; Ca, 7. The inorganic-element content of the seed potato is important for the early stages of growth of the new plant. F.Eng.s. and tables.—D.B.

1646 KUSHIZAKI, M. **Nutrio-physiological study of potato plant. 2. Synthesis and translocation of protein and carbohydrate during growth.** [Japanese] *Res. Bull. Hokkaido Nat. Agric. Exp. Sta.* 1957, No. 73, 48–59, bibl. 20, English summary.

The distribution of carbohydrates and proteins was determined quantitatively in leaf, stem and tuber at 9 stages of growth of the potato plant. [See previous abs.] The period before flowering was characterized by a large increase in protein content [in the plant as a whole] ; and the increase was highest in the leaf. After flowering there was a large increase in the carbohydrate content of the plant as a whole. This increase was chiefly in the tuber ; the carbohydrate content of leaves and stems was consistently low throughout the life of the plant. Amino-acid distribution in seedlings was studied by paper chromatography. Especially noteworthy was the presence of glutamine or alanine in the seedlings which had emerged. F. Eng s. and graphs.—D.B.

1647 WITTENROOD, H. G. and others. Groei en produktie van aardappelen. I. Het verband tussen blad- en knolproduktie. **Studies in development of potato crops. 1. The relationship between dry weights of leaves and tubers.** *Jaarb. Inst. biol. scheik. Onderz.* 1957, 95–115, bibl. 10, English summary and table heads.

Graphical representation as outlined by H. G. Wittenrood [see Abs. 1728] is employed to study the relationship between the dry weights of leaves, stems, tubers and roots of samples taken periodically from 5 potato varieties.—G.M.R.

1648 POTTER, A. L. and MCCOMB, E. A. **Carbohydrate composition of potatoes. Pectin content.** *Amer. Potato J.* 1957, **34**, No. 12, 342–6, bibl. 10. [Agric. Res. Serv., U.S. Dep. Agric., Albany, California]

Russet Burbank, White Rose and Katahdin potatoes were investigated for pectin content, cooking quality and texture. There was little difference in the pectin content of the tubers studied. Pectin content varied with different growing areas and was independent of the sp. gr. of the tubers. There was no correlation between pectin content and mealiness. F.s.—R.B.

1649 CARPENTER, P. N. **Mineral accumulation in potato plants.** *Bull. 562 Maine Agric. Exp. Sta.* 1957, pp. 23, bibl. 14.

Experiments were carried out in 1953–6 to determine the nutrient accumulation in Kennebec potato plants at various stages of growth under conditions of adequate and inadequate fertilization. Data of fresh and dry weights, and accumulations of N, P, K, Ca and Mg, measured at 5-day intervals throughout the growing season are given. Under adequate fertilization, plants accumulated (lb. per ac.) during the growing season, 100 N, 12 P, 200 K, 24 Ca (of which only 0·6 was in the tubers) and 100 Mg.—R.B.

1650 ANAN'INA, V. M. [**Colloid changes in potato plants in relation to their frost resistance.**] [Russian] *Fiziol. Rast. (Pl. Physiol., USSR)* 1958, **5**, No. 1, 81–2, bibl. 7. [Polar/Alpine Bot. Gdn, Kola Filial Acad. Sci. USSR, Kirov, Murmansk]

1651 BATE-SMITH, E. C. and others. **After-cooking discoloration in potatoes.** *Chem. and Industr.* 1958, No. 21, 627–8, bibl. 10. [Low Temp. Sta. Res. Biochem. Biophys., Univ. Cambridge and D.S.I.R.]

After-cooking discoloration occurs predominantly at the stem end of cooked potatoes and is probably due to the formation of a complex between iron and *o*-dihydroxyphenols. Results from investigations indicated that the distribution of blackening in individual cooked tubers is governed mainly by 2 factors interacting : the competition of the chlorogenic-acid group of phenols and citric acid for iron. On the other hand, the difference in the intensity of blackening between one tuber and another can also be modified by a change in pH of the tissue and the amount of iron available.—E.B.O.

1652 HECHELMANN, H. Reihendüngung zu Kartoffeln. [**Band manuring of potatoes.**] *Dtsch. Landw. Pr.* 1958, **81**, No. 17, 164–6.

The advantages of band manuring over surface manuring are discussed and the technique used in dry, medium, and wet soils is outlined.—D.B.

1653 KÜRTEN, P. W. Erfolge mit der Düngungskombination Schwefelsaures Ammoniak und Thomasphosphate. [**Success with the manurial combination of ammonium sulphate and Thomas phosphate.**] *Kartoffelbau* 1958, **9**, No. 1, 10-11, bibl. 3, illus.

Tabulated results of a number of potato fertilizer experiments, conducted in various parts of W. Germany by the Ruhr Stickstoff Co. Ltd., showed that, when applied with the alkaline basic

slag, a N fertilizer which produces an acid reaction, such as ammonium sulphate, gave significantly higher yields of tubers (an increase of 1030 kg./ha.) and starch than did the more usual fertilizer nitro-chalk. Also, the trace-element content of the potatoes was increased and scab disease decreased. This manurial practice is particularly recommended for soils deficient in trace elements.—D.B.

1654 YUNGEN, J. A. and others. **The influence of fertilizer treatment on the yield, grade and specific gravity of potatoes in Eastern Oregon.** *Amer. Potato J.* 1958, **35,** No. 1, 1, 386–95, bibl. 8. [Oregon Agric. Exp. Sta., Corvallis]

The effect of N at 50, 100 and 150 lb./ac. and P and K at 50 and 100 lb./ac. on potatoes was investigated in 16 experiments on irrigated farms. N increased yields of No. 1 ware potatoes on 8 farms, decreased yields on 2 farms, and did not affect yields on 6 farms. There was no clear relationship between yield responses to N and previous crops of legumes or non-legumes, large yield increases occurring on 2 farms following a 3-yr. stand of lucerne. Total yields or yields of No. 1 ware potatoes were not significantly increased by rates of N greater than 100 lb./ac. Of 14 farms where sp. gr. determinations were made, increased N produced significant decreases in the sp. gr. of potatoes on 10 farms ; nearly all sp. gr. values were within the range for good quality. On the 4 farms where P gave yield increases, the soils contained less $NaHCO_3$-soluble P than the soils of farms where no yield increases occurred. K fertilization had no significant effect on yields. Increased rates of N resulted in reduced sp. gr. of tuber samples taken at all stages of tuber growth ; sp. gr. increased progressively with time at all rates of N. F.S.—R.B.

1655 ANDERSSON, Y. and others. Potatisupptagning med maskin. [**Potato-lifting by machine.**] *Medd. 275 JordbrTek. Inst., Uppsala,* 1958, pp. 72, illus.

This publication deals mainly with different types of machinery for harvesting potatoes, but there are sections on : mechanical injuries to tubers, the depth of tubers in the soil and tuber-greening.—P.J.B.

1656 EMILSSON, B. Olika faktorers inverkan på potatisens viktsförlust under lagring. **The influence of various factors on the weight loss of potatoes during storage.** *K. Skogs LantbrAkad. Tidskr.* 1957, **96,** No. 5/6, 329–44, bibl. 14. [Inst. för Växtforskning och Kyllagring, Nynäshamn, Sweden]

There were no significant differences in storage losses between a number of different varieties, provided that the tubers were mature when stored. The results of trials in 1946 to determine the effect of growing potatoes in different districts in Sweden on storage losses gave no reliable results. In trials during 1954–7, 4 varieties were harvested when the tubers were at different degrees of ripeness and there was an initial high-temperature (15°C.) period of storage for some weeks to promote skin maturation. The storage losses (weight) ranged from 5·2 to 7·2%, which indicated that the high-temperature, pre-storage treatment was able to eliminate most of the variation in storage losses due to harvesting at different stages of maturity. In similar trials in 1953–4, in which the previous high-temperature pre-storage period was replaced by storage at 5°C., weight losses ranged from 10·2% for tubers harvested at the normal time, to 20% for tubers harvested very early. In trials in 1946, tubers with 0–5, 5–25, 25–30 and 50–100% of their surface scabbed were stored ; weight losses averaged 3, 3·6, 5 and 10·9%, respectively. In trials in 1950–1, tubers were either handled carefully at harvest, or dropped from a height of 1 metre on to a concrete floor ; respective weight losses at the end of May in the year after harvest were 14·8 and 16·9%, respectively, with percentages of diseased tubers of 5·7 and 7·5. In trials during 1950–2 on the effect of haulm destruction on weight losses as measured by exposing the tubers to an air stream in a wind tunnel at 20°C. for 14 days, weight losses declined progressively from 4·2% (means of 3 varieties) for tubers from untreated plants, to 2·5% for tubers from plants whose haulms had been removed 32 days after harvest. The results of trials in which different storage temperatures, ranging from 0 to 20°C., were used during the initial storage period, showed that temperatures of 10–15°C. were best for promoting suberization and development. In 2 series of trials, temperatures of 0, 2 and 5°C. in the initial storage period resulted in percentages of 8, 1·5 and 0·5 by weight of cold-injured tubers. In 2 further trial series, it was shown that weight losses during storage were high immediately after harvest and fell to their lowest value during January–March.—P.J.B.

1657 BROWNELL, L. E. **Gamma-ray sprout inhibition of potatoes.** *Nuclear Sci. Abstr.* 1958, **12,** No. 6, abstr. 4027. [Michigan Univ., Ann Arbor]

Sebago potatoes given as little as 5000 rep. of γ-radiation showed no signs of sprouting after storage, but Russett Rural potatoes given 20,000 rep. showed occasional evidence of arrested sprout development ; tiny sprouts (7 mm.) formed but did not proliferate. Untreated potatoes except those stored at 35°F. showed sprout development. Ext.—R.B.

1658 DADD, C. V. **Home and dry.** *Fmr's Wkly, Lond.* 1958, **48,** No. 20, 26–9 (Suppl.), illus. [N.A.A.S. Eastern Province]

The principles involved in indoor storage of

potatoes are discussed. Capital costs of new stores range from £7/ton storage capacity for those specially built, to £3 10s.–£4 10s./ton capacity for the Romney-hut type. Recommendations are given for adapting existing buildings for the purpose.—A.M.H.

1659 Aquize, C. J. and Blair, E. Diseño de un depósito para almacenamiento de papas con ventilación controlada. [**Design of a warehouse for storing potatoes with controlled ventilation.**] *Agronomía, Lima* 1957, **24**, No. 90, 31–67, bibl. 29, illus.

Information is given on total yield and areas of cultivation of potatoes in Peru. This crop is grown mainly in the Andes, particularly in the Departments of Puno, Junín, Cuzco and Ancash. Details are given for building a potato store incorporating controlled ventilation. Climate is a limiting factor for using this method of storage which is confined to regions above 3000 m.—E.B.O.

1660 Rothamsted Experimental Station. **Potatoes.** *Rep. Rothamsted Exp. Sta. 1957* Harpenden, 1958, pp. 316, 1 map.

1. Effect of gibberellic acid and kinetin on leaf growth and net assimilation rate, pp. 85–6. By 2 weeks after spraying, gibberellic acid (50 ppm. in water) had increased the leaf area of potato plants sprayed at the 11-leaf stage by 36% on the main shoot and 65% on the laterals. Leaf number was unchanged. Two weeks later, the effect on the main shoot persisted, but that on the laterals had disappeared. At the 1st harvest, leaf and stem weights had increased compared with the control and tuber weights had decreased. At the 2nd harvest, leaf and stem weights were unaffected by treatment, but tuber weights had increased. The mean net assimilation rate was only slightly reduced by gibberellic acid and hence the dry weights of treated plants exceeded those of untreated. Kinetin (0·025 ppm.) decreased leaf area at the 2nd harvest and decreased tuber weight, except in the presence of gibberellic acid.

2. Virus diseases, pp. 107–9. Spraying with DDT emulsion, in 1956, reduced the incidence of leaf roll in Majestic seed tubers from 6% to 1% and that of virus Y from 4% to 1·5%. Spraying increased yields of tubers by 16 cwt./ac., and more than balanced the loss of 12 cwt./ac. caused by tractor damage during spraying. [See also Abs. 1843 and 1795.]—A.M.H.

SWEET-POTATOES

See also Abs. 1852

1661 Slomnicki, I. and Loebenstein, G. **Sweet potato growing trials on heavy soils in the coastal plain and loess soils in the Northern Negev.** *Ktavim* 1958, **8**, No. 1–2, 65–76, bibl. 7.

The yields in both these soil areas are no less, and may exceed, those usually obtained on the light soil of the coastal plain. In the Northern Negev, the tubers may be held in the ground throughout the winter despite the dying-off of the tops. This enables the crop to be gathered in stages. In this area, early planting in May increases yields, but it is possible that the increased cost due to covered nurseries and the loss of the winter-spring crop make the June planting more suitable for the farmer. It seems possible to decrease the number of plants per unit area and to increase the spacing within the row to 40–50 cm. F.S.—M.H.

CASSAVA

See also Abs. 1845, 1849, 1852

1662 Sapin, P. Sélection du manioc à Yangambi. [**Cassava selection at Yangambi (Belgian Congo).**] *Bull. Inform. I.N.É.A.C.* 1958, **7**, No. 3, 181–95, illus.

Information is given on cultural methods for, and toxicity of, cassava.—E.B.O.

JERUSALEM ARTICHOKE

See also Abs. 1858

1663† Tabin, S. and Pawłowski, F. Wpływ rozstawy i obsypywania na plon bulwy (*Helianthus tuberosus* L.). **Influence of spacing and ridging on the yield of *Helianthus tuberosus* L.** *Ann. Univ. M. Curie-Sklodowska Sect. E.* 1956, **11**, No. 9, 243–60. [Received May, 1958]

The highest yield of green matter and of tubers was obtained from the closest spacing (40 × 20 cm.) and the lowest when the spacing was 80 × 80 cm. Ridged plants gave more green weight than unridged, but ridging had little influence on tuber yield. Ridging increased the numbers of tubers per plant. F.Eng.s.—M.H.

1664† Tabin, S. and Pawłowski, F. Wpływ wielkości sadzeniaków na plon bulwy (*Helianthus tuberosus* L.). **Influence of the size of seed tubers on the yield of *Helianthus tuberosus* L.** *Ann. Univ. M. Curie-Sklodowska Sect. E*, 1956, **11**, No. 11, 273–88, bibl. 18. [Received May, 1958]

The data show that best green weights and tuber yields are obtained when tubers weighing 40 g. are planted at 40 × 40 cm. spacing. F.Eng.s—M.H.

1665† Ray, M. P. F. M. **Formation of Jerusalem artichoke tubers in sterile culture.** *Nature, Lond.* 1958, **181**, No. 4621, 1480–2, bibl. 3, illus. [Biol. Lab., Harvard Univ., Cambridge, Mass.]

The data for *Helianthus tuberosus* support the conclusions drawn from culture tests with *Solanum tuberosum* [*Fld Crop Abstr.* 8 : 953].—M.H.

KALE

See also Abs. 1843

1666 Connold, W. Q. **The chemical control of weeds in kale.** *Agric. Rev., Lond.* 1958, **4,** No. 1, 25–7. [N.A.A.S., S.W. Region]

Chemicals considered are H_2SO_4, Na monochloracetate, potassium cyanate and gas liquor. Of these, H_2SO_4 is generally the most effective for control of weeds such as charlock [*Sinapis arvensis*], redshank [*Polygonum persicaria*] and fat hen [*Chenopodium album*].—A.M.H.

FIBRE CROPS

COTTON

See also Abs. 1737, 1751, 1778, 1809, 1852, 1853

1667 Anson, R. R. **Cotton production in Indonesia.** *Emp. Cott. Gr. Rev.* 1958, **35,** No. 2, 85–90, illus.

Cotton has been grown sporadically for hundreds of years and is not only a valuable adjunct to food crops but also constitutes an important raw-material for peasant clothes. Cotton is interplanted with other crops at various times of the year so that its pests easily carry over from one season to the next. This habit will be hard to change and would prejudice large-scale expansions of the crop. Of 138 varieties tested by the Bogor experimental station, Cambodia (*Gossypium hirsutum*) has been the most successful and strains resistant to jassid and blight and with a full staple could be developed.—M.H.F.

1668 Corcelle, P. Influence de la pluviométrie sur la maturité des fibres de coton exprimée par l'indice micronaire. [**Influence of rainfall on the maturity of cotton fibres expressed by the micronaire index.**] *Cot. et Fibr. trop.* 1957, **12,** No. 3, 351–6, bibl. 1.

The results from a study on the cotton variety Allen (common type) produced in the Middle Logone and Middle Shari, French Equatorial Africa, showed a close relationship betweeen fibre maturity expressed by the micronaire index and the late rains in Oct.-Nov. [For description of the micronaire, an air-flow instrument, see 'Cotton', 3rd edn. By Brown and Ware, McGraw Hill Publ., 1958, pp. 404–6.]—E.B.O.

1669 Lombard, P. and Boulet, L. Bilan de cinq années d'essais d'irrigation sur le cotonnier au Maroc. [**Results from 5-years' irrigation trials with cotton in Morocco.**] *Cot. et Fibr. trop.* 1957, **12,** No. 3, 317–34, illus. [Sta. Rech. Cot., Tadla, Morocco]

It is concluded that it is possible to economize on irrigation water during March-May, when an irrigation supplying 600 cu.m./ha., at 20-day-intervals, is sufficient ; 2 irrigations are generally sufficient in June ; but from the beginning of flowering (end of June) to the end of August it is necessary to irrigate every 10 days. Soil moisture should not be less than 65% of the soil-holding capacity. In September, an irrigation should be given immediately before the first harvest (4 Sept.) and a last one between the first and the second harvest. [See also *Fld Crop Abstr.* 11 : 279.]—E.B.O.

1670 Harrison, G. J. and others. **1957 cotton defoliation guide.** [Ext. Serv. Publ.] California Agric. Exp. Sta. 1957, pp. 4.

Tabulated recommendations are given for the use of folex (tributyl phosphorotrithioate), endothal, calcium cyanamide, magnesium chlorate, magnesium chlorate hexahydrate, sodium chlorate and amino triazole.—P.J.B.

1671 Christidis, B. G. **Regional cotton tests. Results of 1956.** [Greek] *Sci. Bull., Cott. Res. Inst., Sindos* pp. 71, 1 map, English summary.

The results are given of 3 trial series in the cotton-growing districts of Greece, in which different varieties and manurial treatments were used. Of introduced varieties, Empire W and Coker 100 W showed high productivity. The locally-produced varieties 15E and 10E also gave high yields. Significant responses to manurial treatment were noted in only a few trials and in these, to the N component, only. F.s.—P.J.B.

1672 Čžen' Ši. [**Rotting of cotton bolls in relation to cultural conditions.**] [Chinese] *Acta Agric. sinica* 1957, **8,** No. 3, 276–91, bibl. 13, Russian summary.

1673 Yin, S. Y. and others. **A further study on the biological control of *Verticillium* wilt of cotton.** [Chinese] *Acta phytopath. sinica* 1957, **3,** No. 1, 55–61, bibl. 8, English abstract.

When Actinomycetes antagonistic [to *Verticillium*] were cultured in cotton-seed cake and used as a fertilizer for cotton, a stimulating effect on the growth of the plant and a decrease in percentage of *Verticillium* wilt were observed. The isolates of Actinomycetes which have shown the best results are G_4 and 5406. Throughout the growing period, 3 applications of fertilizer carrying the antagonist resulted in a 31–50% decrease in disease and a 14–40% increase in crop yield. This treatment is recommended. Buried slide tests showed that the antagonists are most abundant in the soil at a depth of 5–7·5 cm. F. Eng. s.—D.B.

1674 Empire Cotton Growing Corporation. **Progress reports from experiment stations. Season 1956-57. Tanganyika Territory, Eastern Province.** 1958, pp. 15. [Received June, 1958]

Insecticide trials, pp. 12–15. The standard treatment of 1 lb. DDT/ac./week over 2 months gave the best yields of seed-cotton, but control of

American bollworm [*Heliothis armigera*] was still good when the amounts of DDT applied in the 2nd month were reduced to 0·5, 0·25 or 0 lb./ac./week. —A.M.H.

1675 Munro, J. M. **The summer cropping regime in the Lower River, Nyasaland.** *Emp. Cott. Gr. Rev.* 1958, **35**, No. 2, 101–6, illus.

Summer cropping of cotton was introduced in the 1951–2 season, since when all late sowing has been prohibited. The objective was to control damage by red bollworm [*Diparopsis castanea*]. The evidence that summer cropping has been advantageous is inconclusive but pure stand cotton would not otherwise have been introduced. Production has been raised by only 18% but production per grower has increased by over 70%.—M.H.F.

1676 Hopkins, A. R. and others. **Field tests with thimet and Bayer 19639 for cotton-insect control.** *J. econ. Ent.* 1958, **51**, No. 1, 100–2. [S. Carolina Agric. Exp. Sta., Clemson]

Cotton seed was treated with 8 lb. of 44% thimet per 100 lb. seed, or with 50% Bayer 19639 at 3, 6 and 9 lb./100 lb. seed, and sown at 33 lb./ac. Furrow applications of thimet at 1 and 2 lb./ac. were made to untreated seed. All treatments gave good or excellent control of cotton aphis (*Aphis gossypii*) but had practically no effect on boll weevils (*Anthonomus grandis*). Stands of cotton were adversely affected by all seed treatments but not by furrow applications of thimet. The higher of the 2 furrow treatments adversely affected fruiting. None of the treatments affected the quality of the crop or the percentage seed germination. F.s.—R.B.

1677 Gonzáles, B. J. E. Importancia económica y medios de control de los enrolladores de la hoja del algodonero. [**Economic importance of, and control measures against, leaf rollers of cotton.**] *Bol. trim. Exp. agropec., Lima* 1956, **5**, No. 4, 2–7, bibl. 1. [Esta. Exp. Agríc., La Molina, Peru] [Received Apr., 1958]

Cultural, biological and chemical measures are given for controlling *Platynota* sp. and *Argyrotaenia sphaleropa* on cotton. Satisfactory results were obtained by treatment with folidol or parathion applied as a spray by aeroplane at the rate of 2 lb. of technical material per fanegada (= 6400 sq. m.). As this treatment must be repeated at 5–6 days' interval to obtain complete control, it is considerated uneconomical.—E.B.O.

1678 Galichet, P. F. Les principaux parasites du cotonnier au Tchad. [**The principal pests of cotton in the Chad (French W. Africa).**] *Cot. et Fibr. trop.* 1957, **12**, No. 3, 357–406, bibl. 21, illus.

Control measures are given.—E.B.O.

1679 Caresche, L. Protection du cotonnier contre les insectes nuisibles à Madagascar. [**Control of cotton pests in Madagascar.**] *Bull. Madagascar* 1958, **8**, No. 142, 239–51.

1680 Zaffanella, M. J. R. and Zaffanella, Matilde G. El "raquitismo" del algodonero en la región de Las Breñas, Chaco. Investigaciones de sus causas y enmiendas propuestas. ["**Rickets" of cotton in Las Brenas region, Chaco (Argentina). Investigations into its causes and suggested remedies.**] *Idia* 1957, No. 119, 1–47, bibl. 20, illus. [Lab. Ecol. Agríc., Salta, Argentina]

Rickets of cotton, which consists of patches of weak, low-yielding plants, affects cotton crops in the west of Chaco province. Investigations indicated that this malady is caused by excessive drought in small areas determined by the relief. Under the semi-arid climate of the region, where the deficit of evapotranspiration is about 400 mm., small differences in the relief (generally not perceptible by eye) produce a normal environment in the depressions, where there is maximum growth of vegetation, and abnormal conditions in the raised areas. This condition is accentuated by the presence of a compact layer of soil which starts at a depth of 10–15 cm. Deep cultivations down to 50 cm. proved beneficial, giving increases in yield of 30–100% over the controls. F.s.—E.B.O.

1681 Kibukanmusoke, D. E. B. **A note on a more precise method of estimating the Uganda cotton crop.** *Emp. Cott. Gr. Rev.* 1958, **35**, No. 2, 91–9.

The precision of the Namulonge cotton crop estimate has been modified by incorporating the relationship between crop size and rainfall (either pre-sowing or during the stage of early boll development) in the regression equations for the different producing districts. It is recommended that in future a preliminary estimate of the Uganda cotton crop be based on unrevised assessments of planted acres at the end of June. This figure should be revised as soon as accurate statistics of acreage, sowing date and pre-sowing rainfall are received. The final estimate should be calculated when post-sowing rainfalls (Sept.-Nov.) become available.—M.H.F.

1682 Senn, E. and Lhuillier, J. Compte rendu d'un voyage d'étude sur la production cotonnière de l'U.R.S.S. [**Report on a journey to study cotton production in the USSR.**] *Cot. et Fibr. trop.* 1957, **12**, No. 3, 289–316, map. [Inst. Rech. Cot. Text. Exot., Paris]

This report on a journey in Oct.-Nov., 1957, gives information on cotton in the USSR, including : areas of cultivation, production, organization, prices, research, varieties, cultural methods and irrigation.—E.B.O.

1683 Empire Cotton Growing Corporation. **Progress reports from experiment stations. Season 1956-1957. Northern Nigeria.** London, 1958, pp. 22. [Received June, 1958]

1. Seed stocks trial, p. 5. Two 26J stocks gave higher yields and lint lengths and were appreciably earlier than commercial or multiplication stocks of 26C. The multiplication stock of 26C yielded slightly more than the commercial, was more uniform and more resistant to jassid.

2. Cross-tying of furrows, p. 7. This gave a 14% increase in yield of seed cotton, in a season of below-average rainfall.

3. Survival of *Xanthomonas malvacearum* in cotton trash, pp. 8–9. Seed disinfection with agrosan GN5 at 1 : 150 reduced seedling infection from 1–72% to 0·06–1·5%, in the absence of trash. With untreated seed at a low level of seed-borne infection, addition of infected trash caused a small increase in infection. This effect was not apparent at moderate initial infection levels ; high initial levels were reduced by addition of trash. In the presence of agrosan, trash raised the level of infection markedly when it had originally been low and restored it to a substantial level again when it had been moderate or high before the use of agrosan. Trash protected from weathering gave a greater % infection than weathered trash.

4. Varietal reactions to bacterial blight, pp. 9–12. 26J was the most susceptible variety in the early stages. Later it showed greater tolerance and the highest stem resistance. Susceptibility of MU8A and BP52 increased with age. BAR7/8.2 was highly resistant.

5. Seed treatments and incidence of bacterial blight, pp. 13–14. State of seed (raw, machine-delinted once or twice, or acid-delinted), sowing-time and site differences did not impair disinfection with agrosan GN5. Acid-delinting was as efficient as agrosan.

6. Insecticide trials, pp. 18–21. At Samaru, June or July sowing gave higher yields than August sowing, in sprayed and unsprayed plots. Spraying with 2 lb. DDT+0·6 lb. γ BHC/ac. gave increases of 18–186 lb. seed cotton/ac., depending on sowing-date. Endrin gave increases of a similar order. At Kontagora, 4 applications of 2 lb. DDT + 0·6 lb. γBHC/ac. at 54 gal. of emulsion/ac. gave greater yield increases when applied in Sept.–early Oct. than in Oct.–early Nov., on June- and July-sown crops. At Mokwa, spraying with 2·4 lb. DDT + 0·7 lb. γ BHC/ac. increased yields of June-sown crops by 226%, July-sown crops by 95% and August-sown by 15%. Spraying had no effect on the yield of Sept.-sown crops.—A.M.H.

1684 Empire Cotton Growing Corporation. **Progress reports from experiment stations. Season 1956-57. Tanganyika Territory, Lake Province.** 1958, pp. 24. [Received June, 1958]

1. Time of sowing, p. 4. Mid-November and mid-December sowings gave similar yields. Mid-January and mid-February sowings yielded 80% and 50%, respectively, of the yields from November and December sowings.

2. Land-resting, p. 4. The 3rd cotton crop following a 3-yr. tumbledown fallow still showed a 45% increase in yield compared with the 3rd crop following 3 crops of millet. Cotton after 1 yr. of clean, bare fallow yielded significantly less, and after 1 yr. of tumbledown fallow significantly more, than the continuously cropped control.

3. Manurial trials, pp. 4–8. There were still residual responses to heavy dressings (7 tons/ac.) of farmyard manure and compost and 1·5 tons cotton-seed ash/ac. applied in 1944. Plots receiving 7 tons/ac. farmyard manure in 1944, '52 and '55 showed an increase of over 700 lb. seed cotton/ac. over the control. Ammonium sulphate (175 lb./ac.) applied annually in March 1953–6 increased the residual response to ash from 300 lb. to 741 lb. seed cotton/ac. 90 lb. urea and 150 lb. basic slag/ac. increased yield by 700 lb., a similar increase to that resulting from use of compost at 6 tons/ac.

4. Soil moisture, pp. 12–13. Determinations with nylon electrical-resistance units showed that water removal by the crop occurred mainly from the ridges and the soil below them, little of the reserve below the furrows being tapped.

5. Strain trials, pp. 13–18. 55/106 ex 0/334, one of the constituents of Uk55, was significantly higher-yielding than Uk51 or Uk55 and had a yarn-appearance grading of 1·5 compared with 3 for Uk55. NC56, from Namulonge, gave only 73% of the Uk51 yield. O/334 outyielded Uk55 in Lake-fringe plots.—A.M.H.

1685 Department of Agriculture, Tanganyika. **Annual Report for 1956, Pt 2.** *Dep. Agric. Tanganyika* Dar-es-Salaam, 1958, pp. 106.

Ukiriguru, pp. 4–26. Provincial yields from cotton averaged 144 lb. lint/ac. from WK51 and the importance of timely sowing was demonstrated. With 3 years fallow and millet/3 years cotton rotation, the second-year cotton yields following 'tumbledown' fallowing were similar to those following millet rotations where compost was added every fourth year. With one-year tests, the major profit was recovered where phosphate had also been applied. Fertilizer studies confirmed that the fullest use should be made of cattle manure and, where unavailable, phosphates should be employed. Where there is a sufficiency of phosphate, annual applications of N should be applied because of the worthwhile NP interactions. In a fertilizer trial, 8/290 and 0/328 gave comparable seed-cotton yields (1800 lb./ac.) but 0/457, in spite of acid treatment of the seed, suffered severely from

blackarm. Ilonga, pp. 40–58. The essentiality of early sowing of jassid-resistant cotton at a proper spacing interval, followed by timely DDT/BHC applications, was emphasized. Cotton interplanted with maize gave lower yields but a poor stand of interplanted short-strawed sorghum did not depress cotton production.—M.H.F.

FIBRE FLAX

1686 Pontoppidan, H. C. Vanding af spindhør. **Trials with watering of fibre flax.** *Lin* 1958, **12**, No. 3, 21–32, bibl. 9. [Taastrup Horskætteri, Denmark]

In 7 trials during 1952–7 at Taastrup, fibre-flax crops were irrigated with 25 mm. water given in one application (except in one case) at a rate of 8–10 mm./hr. Irrigation resulted in average yield increases in all 7 trials of 696 kg. crude fibre, 191 kg. scutched fibre and 64 kg. seed/ha. Fibre quality also was substantially improved. In most cases, the crops were irrigated when 8–12 cm. high. There was a clear tendency for irrigation to produce the highest yield increases when rainfall was deficient during the middle third of the growth period. Rainfall amounts during the last third of the growth period had relatively little effect on fibre yields. The effect of rainfall on seed yields was much less consistent than its effect on fibre yields. From practical experience it was concluded that irrigation of fibre flax at an early growth stage could be strongly recommended, though only under the following circumstances : (a) where there was no appreciable residual nitrogen effect from the previous crop and only on normal arable soils, (b) where irrigation could be done within 10 days of the crop reaching a height of 8 cm., (c) where the soil was dry enough to absorb and hold 20–25 mm. of water.—P.J.B.

1687 Netherlands Institute for Research on Varieties of Field Crops. **Seed bulletin 1957 : Fibre flax.** *Neth. Inst. Res. Var. Fld Crops, Wageningen*, 1957, pp. 7, illus.

1688 Byčkova, Z. I. **Chemical weed control in flax.** [Russian] *Vestn. sel'skohoz. Nauki* (*J. agric. Res. USSR*) 1958, **3**, No. 4, 137–9, English and German summaries.

Tests made during 1950–6 by the All-Union Flax Institute and the White Russian Regional Experimental Station for Flax Production have shown that the highest fibre output (800 kg./ha.) was obtained when the plants (at 6–8 and 12–20 cm. height) were treated with 2, methyl-4 chlorphenoxyacetic acid (sodium salt) [MCPA] at the rate of 0·5 and 0·65 kg./ha. Germination capacity and absolute weight of the flax seed were not affected by the chemical. F. Eng.s.—M.H.

HEMP

1689 Kohler, D. Die Entwicklung von *Cannabis sativa* unter dem Einfluss verschiedener Tageslängen. [**The development of *Cannabis sativa* as affected by different photoperiods.**] *Physiol. Plant.* 1958, **11**, No. 2, 249–59, bibl. 12, illus. [Bot. Inst. der Technischen Hochschule, Braunschweig, W. Germany]

OIL CROPS

SESAME

1690 Patil, J. A. and others. **'Til. 85' — an improved strain of *Sesamum*.** *Farmer, Bombay* 1958, **9**, No. 5, 15–16, illus.

OIL-SEED FLAX

See also Abs. 1707, 1708, 1857

1691 Willey, L. A. and Bunting, E. S. **Linseed trials 1952-55.** *J. nat. Inst. agric. Bot.* 1957, **8**, No. 1, 96–105, bibl. 6. [N.I.A.B. Regional Trials Centres and A.R.C. Unit of Exp. Agron., Oxford]

The results are given of a series of 17 linseed variety trials. Svalöf Oilflax II was high yielding ; Valuta, Dæhnfeldt Elite No. 6 and B.1528 also gave good results. The order of ripening of the main series of varieties was Dakota (earliest), Redwood, Svalöf Oilflax II, B. 1528, Trifolium Record, Dæhnfeldt Elite No. 6, Valuta. Brief accounts of other agronomic and floral characters are given for these varieties, as well as data on 25 other varieties grown on a limited scale. F.s.—A.M.H.

SAFFLOWER

1692 Argikar, G. P. and Salanki, M. S. **A study of growth habits in safflower (*Carthamus tinctorius* L.).** *Indian Oilseeds J.* 1958, **2**, No. 1, 13–17, bibl. 2.

Quantitative observations were recorded on the morphology of 26 strains of *C. tinctorius* during the rosette stage, shooting stage and at maturity.—D.B.

SUNFLOWER

See also 1707, 1708, 1715, 1753, 1857

1693 Putt, E. D. **Sunflower seed production.** *Publ. 1019 Canada Dep. Agric.* 1957, pp. 19, illus. [Exp. Fm, Morden, Manitoba]

Practical recommendations are given for growing sunflowers in Canada.—R.B.

RAPE

See also Abs. 1710, 1857

1694 Statens Forsøgsvirksomhed i Plantekultur. Denmark. Forsøg med stammer af vinterraps 1950–1957. [**Trials with varieties of**

winter rape, 1950-7.] *Medd. 602 Stat. Forsøgsvirk. Plantekult.* 1958, pp. 2.

The trials reported were carried out at 4 locations in Denmark with 4 varieties of winter rape [*Brassica napus* var. *oleifera* subvar. *biennis*]. Yields of Svalöf Matador (24 trials), Hammenhögs Regal (19 trials), Lembkes and Svalöf Matador C (9 trials) averaged 21·2, 21·4, 20·7 and 21·7 hkg./seed/ha. and 871, 885, 844 and 894 kg. crude oil/ha., respectively. The oil content of the seed ranged from 40·8 to 41·4%. The crude-protein content of the seed and the date of maturation were nearly the same for all varieties. Brief notes are given on each variety.—P.J.B.

1695 MANNER, R. Hammenhögs Original Vestal höstraps. [**Hammenhögs Original Vestal winter rape.**] *Medd. 14 Gullåk. VäxtförädlAnst.* 1957, 57–60, bibl. 3, English summary.

Vestal winter rape [*Brassica napus* var. *oleifera* subvar. *biennis*] was released in Sweden in 1956. In trials at Gullåker in 1952–7, respective average seed yields of Vestal and Regal in 11 trials were 3136 and 2887 kg./ha., of Vestal and Matador in 6 trials, 2618 and 2427 kg. and of Vestal and Margo in 5 trials, 2427 and 1991 kg./ha. In official trials in 1953–6, yields of Vestal and Matador in 31 trials averaged 2307 and 2269 kg./ha., Vestal and Lembke in 30 trials averaged 2316 and 2163 kg. and Vestal, Regal and Margo in 29 trials averaged 2300, 2224 and 2219 kg./ha., respectively. In trials in Gotland, Vestal was outyielded by Matador, Regal and Margo. The oil content of Vestal in 4 trials averaged 46·1%, followed by 44·6% for Regal. Vestal overwintered better than Regal, Margo and Matador.—P.J.B.

1696 KANNO, C. and KOMEMOTO, T. **A new rape variety "Suehiro-natane."** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 179–82, illus., English summary.

This variety [of *Brassica napus* var. *oleifera* subvar. *biennis*] registered in 1952 has short, much-branched stems ; it is early, resistant to excessive moisture, high yielding, and rich in oil. It grows well as a winter crop after rice in Tokai, Kinki and Hokuriku, and is now recommended for several other areas in the southern part of Japan. F. Eng. s.—D.B.

1697 KANNO, C. and others. **A new rape variety "Isuzu-natane."** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1956, No. 3, 183–6, illus.

This recently registered new rape hybrid is an interspecific cross between Rape Norin No. 10 (*Brassica napus*) and Wasena (*B. campestris*). It is very early, resistant to sclerotium disease, white rust and boron deficiency and is recommended for Gifu, Mie and Nara Prefectures. F. Eng. s.—D.B.

1698 ANDERSSON, G. Oljeväxtodlingens kvalitetsproblem. **The quality problem in oil-plant-growing and ways of quality amelioration in oil-plant husbandry in Sweden.** *Sverig. Utsädesfören. Tidskr.* 1957, **67**, No. 4/5, 312–22, English summary.

Ways in which growers of Brassica oil-seed crops can improve the qualitative attributes of their products are reviewed. Attributes considered include : moisture content, purity, oil content of the seed, content of free fatty acids, degree of seed-ripeness, and damage through overheating and mechanical breakage. The question of oil content is considered from the point of view of N treatment, dates of sowing and harvest and choice of variety. —P.J.B.

1699 RUTKOWSKI, A. and MAKUS, Z. Einfluss des Reifungsgrades der Rapssamen auf die Stabilität des Öles. [**Effect of stage of maturity of rape seed on the stability of the oil.**] *Oléagineux* 1958, **13**, No. 1, 203–5, bibl. 12, French summary. [Inst. Fett Industr., Warsaw, Poland]

1700 OLIN, E. Oljeindustrins krav på raps- och rybsfröerna. [**The qualitative requirements of Swedish oil-seed mills for rape and turnip-rape seed**]. *Sverig. Utsädesfören. Tidskr.* 1957, **67**, No. 4/5, 307–11, English summary. [Karlshamns Oljefabriker, Sweden]

Indices of quality used by the Swedish oil-seed milling industry for judging samples of rape [*Brassica napus* var. *oleifera*] and turnip-rape [*B. campestris* var. *oleifera*] are enumerated and briefly discussed. They include eight properties (beside moisture and crude oil contents), as follows : (a) content of free fatty acids in the crude oil, (b) degree of ripeness, (c) content of heat-damaged seeds, (d) content of broken seed, (e) purity, (f) hectolitre weight, (g) content of seeds damaged by micro-organisms, (h) whether rape or turnip-rape seed. Rape seed has certain advantages over turnip-rape seed, including higher oil-content and greater seed-size, which, for given oil-seed mill capacity, means that more rape than turnip-rape seed can be processed.—P.J.B.

MUSTARD

1701 KANNO, C. **Studies on shrinking of plant and failure in fruiting in rape plants.** [Japanese] *Bull. Div. Pl. Br. Cultiv., Tokai-Kinki Nat. Agric. Exp. Sta.* 1957, No. 5, 1–103, bibl. 115, illus., English summary.

Since 1949 there has been a widespread occurrence of shrinkage of *Brassica napus* plants during the winter months and failure to set seed in the spring. These effects were caused by B deficiency and could be controlled by an early application of B at 10–30 monmes per tan [1

monme = 3·75 g. 1 tan = 9·917 are] preferably as a foliar spray. B treatment of the rape crop did not change the yield of the subsequent rice crop, but it was followed by a lower yield of oats harvested in the green state. F. Eng. s. —D.B.

1702 MANNER, R. **Studies in winter rape (*Brassica napus oleifera*). 2. Correlations between different characters.** *Medd. 14 Gullåk. VäxtförädlAnst.* 1957, 61–94, bibl. 6.

The experimental material studied consisted of the progeny of single plants of the winter-rape varieties Lembke, Matador and Regal [*Brassica napus* var. *oleifera* subvar. *biennis*], selected in 1950. Correlations were determined between certain valuable agronomic characters and a number of morphological characters. The following characters were studied : (a) plant-stand density in autumn, (b) seed colour, (c) plant-stand density in spring, (d) date of flowering, (e) plant height at early July, (f) straw-stiffness, (g) winter-survival of plants, (h) seed yield, (i) moisture content of the seed, (j) 1000-grain weight, (k) percentage of inert matter in recently-harvested seed, and (l) germination capacity. Data are given of the minimum, mean and maximum values for the characters studied in the 3 varieties.—P.J.B.

1703 MAINI, N. S. and NEGI, L. S. **Preliminary study on the effect of time and method of placement of fertilizers on yield of raya (*Brassica juncea* Coss).** *Indian Oilseeds J.* 1957, **1**, No. 5, 335–8, bibl. 5. [Oilseeds Res. Sta., Gurgaon, Punjab]

Ammonium sulphate and superphosphate were applied at 50 lb. N and 25 lb. P_2O_5 per acre. Both fertilizers gave increases in yield but the magnitude of the increase varied with the time and method of placement. In the case of ammonium sulphate, the highest yields were obtained when the fertilizer was drilled 4–5 in. deep before sowing; the second highest yield was obtained by drilling half the fertilizer before sowing and broadcasting the other half with the first irrigation. Using superphosphate, significant yield increases over control were obtained by drilling the fertilizer 4–5 in. deep before sowing. Plant height, number of pods per plant, and number of seeds per pod were greater when these fertilizers were drilled before sowing than when broadcast later.—D.B.

NIGER SEED

1704 PATIL, J. A. and others. **Improved variety of niger for Bombay Deccan.** *Indian Oilseeds J.* 1958, **2**, No. 1, 1–4, bibl. 8.

An account is given of the cultivation, harvesting and uses of *Guizotia abyssinica* which is grown under moderate rainfall (not exceeding 40 in.) in hill country in Mysore, Madras, Madhya Pradesh, Bihar and Bombay. It is grown in the monsoon season, usually as a mixed crop with cereals or millets and pulses. The crop matures in 110–120 days from sowing. A pure stand yields 200–300 lb. seed/ac. As a result of 3-yr. trials, N12–3 has been selected as the highest oil-yielding variety. N13–2 is also good. Because of cross fertilization, seed multiplication must be carried out in isolation.—D.B.

POPPY

1705 VAN ROON, E. Blauwmaanzaadonderzoek in 1957. **[Poppy research in 1957.]** *Meded. 9 Proefsta. Akker- en Weidebouw, Wageningen* 1958, pp. 24.

On nitrogen-poor soils in the Noordoostpolder region of the Netherlands, applications of 135 kg. N/ha. gave the highest poppy seed yields ; 80 kg. N/ha. were generally sufficient on good soil. Newly-ploughed pasture land was not suitable for poppy cultivation. Split applications of N produced 10–15% more seed than applying the total amount of N at sowing time. The best time for the second application of N was about a week before the onset of flowering. Urea was satisfactory for replacing nitrochalk for the second N application; high concentrations (400 l. of 30% solution/ha.) did not cause leaf scorch ; seed production was improved and the seed/stem ratio was greatly increased. For ease of sowing, it was profitable to mix seed of black medick [*Medicago lupulina*] with poppy seed. With a small quantity of poppy seed (0·67 kg./ha.) in the mixture, thinning-out in the field was unnecessary. The medick had no adverse effect on the poppy crop, and the dry-matter production of the medick was about 2650 kg./ha. Dense stands of poppy were very susceptible to lodging. The optimum row spacing for the 1957 crop seemed to be 20 cm., provided that the number of plants per metre of row was not above 10. With relatively higher numbers of plants per m. of row, which is usually the case in practice, the optimum spacing between rows was 33·3 cm. ; a spacing of 50 cm. between rows increased the likelihood of wind damage. Earthing-up brought about an appreciable increase in stem rigidity, and, especially in the case of rows 50 cm. apart, produced significant increases in seed yield. F.S.—R.B.

GOLD OF PLEASURE

1706 MÜLLER, K. H. Anbauwürdigkeit und Anbautechnik des Leindotters. **[Cultivation technique of Gold of Pleasure.]** *Dtsch. Landw.* 1958, **9**, No. 2, 65–7, bibl. 8.

Results of experiments in Jena, Halle/Lauchstädt and Bad Salzungen indicate the best cultivation techniques for *Camelina sativa* in these areas of Eastern Germany. The best yields were obtained by sowing between late March and early April, at the rate of 8 kg./ha., in drill rows 20 cm. apart.

Commercial fertilizers at the rate of (kg./ha.) 54 P_2O, 80 K_2O and 50 N proved satisfactory. The average oil yield of 440 kg./ha. was exceeded only by sunflower. Considered as a crop, *Camelina sativa* has several advantages. It develops earlier than other spring oil-bearing crops and can withstand late frosts. Weed control, harvesting and threshing offer no special problems. The harvest is a dependable one and the crop matures in early August.—D.B.

GENERAL

1707 Jaky, M. Die Untersuchung verschiedener ölhältiger Samensorten in Ungarn. [**An examination on several oil-seed-bearing varieties in Hungary.**] *Oléagineux* 1958, **13,** No. 1, 149–51, bibl. 28, French summary. [Inst. Rech. Huiles Vég., Budapest]

This study is concerned with the problem of growing oil-crops in Hungary, and gives data of chemical composition of their seed. Among the species considered are : sunflower (*Helianthus annuus*), the most important oil-crop in Hungary, *Cucurbita pepo*, *Linum usitatissimum* and *Zea mays*. F. Fr. S.—E.B.O.

1708 Lachover, D. and others. **Effect of ethylene dibromide fumigation on the viability of oil seeds.** *Ktavim* 1958, **8,** No. 1–2, 11–20, bibl. 8.

In reducing damage to the viability of oil seeds fumigated with ethylene dibromide, the most important factor is post-fumigation airing. The higher the oil content of the seeds, the longer should they be aired after treatment. A concentration equivalent to 70 g. of EDB per cu. m. is least harmful. At this level, sunflower and flax seeds may be sown after 7 days' airing, while sesame and sorghum seeds, which are most sensitive to bromine-damage, require 15–30 days' airing. Groundnuts should be left unshelled for fumigation, as the shell absorbs almost all the bromine and protects the viability of the seed. F.S.—M.H.

CROP BOTANY

PHYSIOLOGY

1709 Semenenko, G. I. **The transformation of nucleic acids in germinating and maturing seeds [wheat, oats, peas].** [Russian] *Fiziol. Rast.* (*Pl. Physiol., USSR*) 1957, **4,** No. 4, 332–7, bibl. 29, English summary. [Gorky Univ., Har'kov]

1710 Allerup, S. **Effect of temperatures on uptake of water in seeds.** *Physiol. Plant.* 1958, **11,** No. 1, 99–105, bibl. 14. [Pl. Physiol. Lab., Roy. Vet. and Agric. Coll., Copenhagen, Denmark]

Data are given of the water uptake by seeds of wheat, pea and summer rape [*Brassica napus* var. *oleifera* subvar. *annua*] during a 30-hr. period at temperatures of 5, 15, 25, or 35°C. Water of controlled purity was used and the water content of the seed was calculated as a percentage of the dry matter. In all cases, water uptake was most rapid during the first 5 hours of treatment and decreased progressively with time. The curve of water uptake by pea seed at 5°C. was sigmoid, however. The water in which the seed was soaked contained enough O_2 to permit germination, which took place in peas and rape at 25°C., and in wheat at 15, 25 and 35°C. Water uptake proceeded at the same rate after germination as before. The final water content of pea, rape and wheat seed was 140, 80 and 60%, respectively. It appeared that seeds with a high protein content were able to take up much more water than starchy seeds, and at a greater rate. The final amount of water taken up by rape seed was independent of temperature ; in the case of wheat and pea seed, this was not the case. The effect of temperature on water uptake varied from species and also with time, i.e., with the content of water in the seeds.—P.J.B.

1711† Schoorel, A. F. De invloed van extreme temperaturen en van uitdroging op de kiemkracht van zaden. [**The influence of extremes of temperature and of drying on the germinating capacity of seeds.**] *Landbouwk. Tijdschr., Wageningen* 1958, **70,** No. 2, 117–22, bibl. 24.

This is a literature review.—R.B.

1712 Tjurina, M. M. [**Determination of the water-retaining capacity of plant tissues.**] [Russian] *Fiziol. Rast.* (*Pl. Physiol., USSR*) 1957, **4,** No. 4, 378–84, bibl. 27, English summary. [Pamir Biol. Sta., Acad. Sci. Tadžik SSR, Murgab]

1713 Kristensen, K. J. Afgrødernes Vandbehov og Vandforsyning. [**The water requirements and water supply of crops.**] *Tolvmandsbladet* 1957, **29,** No. 2, 49–52 and No. 3, 70–3, bibl. 16. [Hydroteknisk Lab., K. Vet. og Landbo-Højskole, Copenhagen, Denmark]

1714† Parry, D. W. and Smithson, F. **Silicification of bulliform cells in grasses.** *Nature, Lond.* 1958, **181,** No. 4622, 1549–50, bibl. 9, illus. [Sch. Agric. Univ. Coll. N. Wales, Bangor]

The deposition of silica in these cells is considered in regard to function of the depositions and the water relations of the plant.—M.H.

1715 Winneberger, J. H. **Transpiration as a requirement for growth of land plants.** *Physiol. Plant.* 1958, **11,** No. 1, 56–61, bibl. 4. [Bot. Dep., Univ. California, Berkeley]

Transpiration, while known to be related to

the movement of water and salts in plants, has not been considered to be a function essential to growth. In the experiments reported, plants, including germinating seed and young plants of sunflower [*Helianthus annuus*], were held in conditions as far as possible approaching 100% relative humidity. Transpiration was not completely stopped under the conditions of these experiments, but growth rates were reduced by about half in the sunflower plants, though there was no evidence of leaf chlorosis or other symptoms of nutrient deficiency. It was concluded that these results showed that translocation was an essential condition for growth in some higher plants. It is conjected that transpiration is responsible for translocating organic and inorganic solutes between and within cells and is the energy source for this function.—P.J.B.

1716 ČAĬLAHJAN, M. H. and BAVRINA, T. V. **Effect of daylength on the pigment content in plant leaves.** [Russian] *Fiziol. Rast.* (*Pl. Physiol., USSR*) 1957, **4**, No. 4, 312–21, bibl. 15, illus., English summary. [Timirjazev Inst. Pl. Physiol., Acad. Sci. USSR, Moscow]

1717 PETINOV, N. S. and MOLOTKOVSKIĬ, Ju.G. **[Protective reactions in heat-resistant plants induced by high temperatures.]** [Russian] *Fiziol. Rast.* (*Pl. Physiol., USSR*) 1957, **4**, No. 3, 225–33, bibl. 15, illus., English summary. [Timirjazev Inst. Pl. Physiol., Acad. Sci. USSR, Moscow]

1718† ALEKSANDROV, V. Ja. and FEL'DMAN, N. L. **[Increase of cell resistance as a reaction to high temperature.]** [Russian] *Bot. Ž., SSSR* (*Bot. J., USSR*) 1958, **43**, No. 2, 194–213, bibl. 48, English summary. [Komarov Bot. Inst., Acad. Sci. USSR]

[See also *Fld Crop Abstr.* 10 : 1187.] This work was designed to elucidate : (a) the dependence of the hardening effect on °T, on the duration of the hardening action, and on the time elapsing after treatment ; (b) the effect of heat-hardening on cell resistance to heat and to the action of other agents (e.g. alcohol, acetic acid, high hydrostatic pressure) ; (c) the nature of the " tuning" of cells to the effect of high °T ; (d) the connexion between heat- and cold-hardening and the inherent resistance of cells to high temperature. The study was made with *Dactylis glomerata*, *Panicum miliacum*, *Elymus arenarius* and *Eleusine indica*, among others. There is evidence that heat-hardening lowers the sensitivity to heat of the epidermal cells in some plants and is accompanied by an increase in resistance of the cells to the injurious agents noted above.—M.H.

GROWTH AND REPRODUCTION

1719 BERGMANN, W. Über die Beeinflussung der Wurzelbehaarung von Roggenkeimpflanzen durch verschiedene Aussenfaktoren. **[Root-hair development in rye seedlings as affected by different environmental factors.]** *Z. PflErnähr. Düng.* 1958, **80**, No. 3, 218–24, bibl. 15, illus. [Landw. Chem. Inst., Univ. Jena]

In rye seedlings, grown in quartz sand and water cultures, intensive development of root hairs was observed when there was an accumulation of bicarbonate ions in the immediate vicinity of the roots. In these experiments this was the case when the water content of the quartz sand was low, when $CaCO_3$ was added to the sand cultures, when there was increased root respiration, and when gas exchange in the soil atmosphere was inhibited ; and in the water cultures, when the roots grew in a small volume of water. There was little or no development of root hairs when the roots grew in a large volume of water which in addition was shaken, or when the respiratory carbon dioxide was absorbed by activated carbon.—G.M.R.

1720 HUMPHRIES, E. C. **Effect of removal of a part of the root system on the subsequent growth of the root and shoot.** *Ann. Bot., Lond.* 1958, **22**, No. 86, 251–7, bibl. 2. [Rothamsted Exp. Sta., Harpenden, Herts]

Removal of up to 50% of the roots of barley and rye had no effect on the growth rate of the remainder of the root system, measured as increment of root dry-matter in a given time, which was the same as in the intact plant. The growth rate of the shoot decreased as the % of roots removed increased. When more than 50% of the roots were removed, root growth declined, but not as rapidly as that of the shoot. When the nutrient supply was not limiting, the total K uptake and the dry-matter increase (both expressed as % of the value for intact plants) were 77 and 78% respectively for barley plants with 35% of the roots excised and 66 and 68% for plants with 48% of the roots excised. Under low nutrient conditions the K uptake was a lower % of that in the intact plant than was the dry-matter increase.—A.M.H.

1721 BLOODWORTH, M. E. and others. **Root distribution of some irrigated crops using undisrupted soil cores.** *Agron. J.* 1958, **50**, No. 6, 317–20, illus., bibl. 11. [Texas Agric. Exp. Sta., College Sta. and Weslaco]

Using a simplified method for determining the root population in irrigated soils, where a ' plow-sole ' layer existed, the authors record the number and weights of root pieces in the different soil layers under eight crops. The top 6 in. contained over 50% and the top 12 in. over 80% of the root weight in 5-ft. profiles and a better comparison, between crops in relation to the physical properties of the soil, is claimed if the numbers and hence the size distribution of the roots is also determined.—M.H.F.

1722† MODILEVSKIĬ, Ja. S. **[Ontogenesis of**

higher plants and the theory of phasic development.] [Ukrainian] *Ukr. bot. Ž. Kiev* (*Ukrainian Bot. J.*) 1958, **15**, No. 1, 3–21, bibl. 47, Russian and English summaries.

Four stages in ontogenesis which are recognized in angiosperms are described, viz. the proembryonic, the first and second embryonic, and that of ecological adaptation. This last stage appears in different forms as the vernalization phase, the photophase and others as yet unstudied. F. Eng. s.—M.H.

1723† Efeĭkin, A. K. [**The localization of thermal and photoperiodic influences which induce flowering in plants.**] [Russian] *Doklady Akad. Nauk SSSR* (*Proc. Acad. Sci. USSR*) 1958, **117**, No. 6, 1068–9, bibl. 15, illus. [Čuvaš Agric. Inst., Čeboksary]

It is recognized that winter annual and biennial plants which are adapted to the seasonal fluctuations in temperature and daylength of high latitudes, progress to the flowering stage only after being subjected, for a definite period, to low temperature and, subsequently, to long day. The author designed experiments (with fodder-beet) to study the localization within the plant of this vernalizing influence. [See also *Fld Crop Abstr.* 10 : 1624.] On 20 March, 8 plants which had overwintered in a greenhouse were chosen for the test. After the formation of rosette leaves and the initiation of the flowering stems (9 May), the growing tips of the plants were cut away. There remained on the plants 3 or 4 outer leaves of the rosette. By systematically removing buds which arose on branches and in the axils of these leaves, adventitious buds were induced on the cut stems. On 5 plants (among the total of 8) there were 18 adventitious shoots, which flowered on 12 July. This confirms that the stimulus, induced by low temperature and necessary for flowering, is not in the growing tips. The author maintains that the transition of plants from the vegetative to the reproductive phase depends not on restricted local changes in the meristem, but on the condition of the plant organism as a whole.—M.H.

1724 Smid-Wiersema, A. C. and van Dobben, W. H. De betekenis van de basisbelichting voor de fotoperiodische reactie. **The significance of the " basic " daylight exposure for photoperiodical reaction.** *Jaarb. Inst. Biol. Scheik. Onderz.* 1957, 51–5, bibl. 1, illus., English summary and table heads.

Plants were exposed to assimilatory daylight for a varying number of hours, followed by supplemental artificial illumination to give a total photoperiod of 17 hr. The duration of the basic daylight exposure affected the date of flowering of several crop plants and crop varieties to differing extents. The effect of the basic light exposure was clearly distinguishable from that of the photoperiod. There was no interaction between the two kinds of light regime : a deficient " basic " daylight exposure delayed the date of flowering independently of the photoperiod. Yellow lupins appeared practically day-neutral in respect of photoperiodism. The differences obtained by weak supplementary artificial light were non-significant. The date of flowering, however, could be delayed by limiting the basic daylight exposure ; this did not imply that yellow lupin could be classified as a long-day plant. F.s.—G.M.R.

1725 van Dobben, W. H. De betekenis van de fotoperiodiciteit in akker- en weidebouw. [**The significance of photoperiodicity in arable and pasture farming.**] [*Summary of paper read at symposium, " The significance of photoperiodicity in agricultural, horticultural and forestry practice", 23rd Oct. 1957, Netherlands.*] *Landbouwk. Tijdschr., Wageningen*, 1958, **70**, No. 1, 17–19, illus.

A relationship exists between the yields of certain crop varieties and the regions in which they are grown. This relationship can be explained in terms of the photoperiodic characteristics of these varieties. The sharper the reaction to daylength, the narrower is the zone in which the crop gives its optimum yields. Crops such as wheat, which have a well-defined long-day response, do not make good catch-crops because they tend to flower too soon after sowing. Maize, a short-day plant, flowers too late in northern latitudes for the crop to ripen successfully.—R.B.

1726 van Dobben, W. H. Het voor fotoperiodische inductie gevoelige stadium bij rogge, tarwe, maanzaad, wikke en vlas. **The photoperiodically responsive stage for rye, wheat, poppies, vetches and flax.** *Jaarb. Inst. Biol. Scheik. Onderz.* 1957, 57–64, illus., English summary and table heads.

Wheat and rye are indifferent to photoperiodical treatment till the third leaf emerges. Poppies and flax show little reaction to daylength in the period when only the coleoptiles are developed. It is doubtful whether vetch (*Vicia sativa*) and peas have an indifferent stage after emergence. In these plants the coleoptiles do not emerge. The experiments were carried out in the open air with constant " basic " daylight exposure and supplementary artificial light to control the photoperiod. When a plant has been treated photoperiodically, flowering cannot be delayed by short-day treatment in the shooting stage. This indicates that for long-day plants " short day " means only " absence of long day " and represents no active process. In comparison with the corresponding acceleration by long day, short-day treatment in the beginning of the responsive stage gives a relatively small delay in flowering and this delay seems to be more or less overcome when the plant is transferred into long-day conditions. This may indicate that the effect

of treatment is greater in large plants than in seedlings. A temperature influence cannot be excluded. F.S.—G.M.R.

1727† Skripčinskiĭ, V. V. [**Certain regularities of tillering in perennial loose-tillered grasses during the first and subsequent years of life compared with related annual grasses.**] [Russian] *Doklady Akad. Nauk SSSR* (*Proc. Acad. Sci. USSR*) 1958, **118,** No. 4, 829–32, bibl. 8, illus.

This study was made during 1952–6 with 12 species of perennial grasses, winter forms of rye, wheat and barley, in addition to spring forms of wheat, barley and oat. From observations on the growth of the plants in culture vessels, the grasses are classified into 3 types : (1) annuals in which the stems (from tillering nodes) live for a few months and then die off, irrespective of whether they have passed to the reproductive stage or not ; (2) perennial grasses with short vegetative stems which live in the vegetative stage not more than a year ; (3) perennial grasses with stems capable of living in the short vegetative condition during 1·5 or 2·5 or 3 years. In the light of the data recorded, the evolution of perennial grasses to the annual type is characterized by two stages, namely, (i) a shortening of the life of the stem from 1·5 or 2 years to a few months (transition of a perennial from group 3 to a perennial in group 2) ; and (ii) a physiological/morphological rudimentation of the tillering node (transition of perennials in group 2 to annuals).—M.H.

1728 Wittenrood, H. G. Grafische voorstelling van de ontwikkeling van een plant. **Graphical representation of plant development.** *Jaarb. Inst. biol. scheik. Onderz. 1957*, 87–94, bibl. 4, English summary and table heads.

The usual ways of representing the trends of plant- and organ-weights derived from periodic sampling are shown in two figures. It is noted, however, that in the first no information can be obtained on the interdependence of the separate organs and in the second no information on the absolute weights. In a third figure the organ weights as ordinates are plotted against the total weights as abscissa. Within each developmental stage these relationships are represented by straight lines. In these figures the interdependence of the " distribution lines " is not apparent. In a fourth figure they are combined in a quadrant which renders their interdependence obvious. There is then added the growth curve of the total plant. By means of the latter and the computed values of the distribution lines, the growth curves of the various organs are constructed in a second quadrant. F.S.—G.M.R.

1729 Warren Wilson, J. and Wadsworth, R. M. **The effect of wind speed on assimilation rate—a re-assessment.** *Ann. Bot., Lond.* 1958, **22,** No. 86, 285–90, bibl. 11. [Bot. Dep., Univ. Reading]

Discrepancies in the results obtained by previous workers, which have indicated both increases in rate of assimilation of CO_2 and decreases in growth rate with increasing wind speeds, are attributed to the different ranges of wind speeds used. It is suggested that with increasing wind speed, growth rate first increases as a result of improved CO_2 supply and then decreases as other harmful effects come into play. This theory is supported by wind-tunnel experiments, in which the growth-rate of small stands of young *Brassica napus* plants increased with rising wind speed, up to an optimum at about 30 cm./sec., and then decreased.—A.M.H.

1730† Toniolo L. and De Poli, E. Contributo allo studio del comportamento di diverse specie agrarie in ambiente salino. [**A contribution to the study of the behaviour of various crops in a saline environment.**] *Agricoltura d. Venezie* 1958, **12,** No. 5, 260–83, bibl. 85, illus.

In the pot trials described, plants of several species were grown with NaCl concentrations of 0·5–3 per thousand parts of dry soil. Tables show data of germination percentages, and of height, green- and dry-matter yield, and Cl content in the aerial part, determined at different stages of development. Results showed that germination and growth were increasingly depressed with increasing concentrations of NaCl in the soil, but not to the same extent in the different species. Beet and oats were the most tolerant to salt. The Gramineae were more tolerant than the legumes. With a concentration of 0·5 per thousand there was a marked decrease in fresh- and dry-matter yield in the legumes, compared with the controls, while in the grasses a difference was evident at much higher concentrations. With a concentration of NaCl of 5 per thousand, the germination of legumes was 12% only of that of the controls. The Gramineae were, in order of decreasing tolerance : barley, rye, wheat, oats ; and the legumes : birdsfoot trefoil, beans, peas, lucerne, red clover. Barley, which up to the concentration of 1·5 per thousand had a green- and dry-matter yield higher than that of the controls, is considered suitable for cultivation on saline soils.—E.B.O.

GROWTH SUBSTANCES

See also Abs. 1431

1731† Zeevaart, J. A. D. Produktie, fysiologische werking en mogelijkheden voor toepassing van een nieuwe groep stoffen: de gibberellienen. [**Production, physiological action and possible applications of a new group of compounds : the gibberellins.**] *Landbouwk. Tijdschr., Wageningen* 1958, **70,** No. 2, 123–35, bibl. 43.

This is a review of the history of the discovery of gibberellins and the experimental work so far carried out with them.—R.B.

1732 KATO, J. **Studies on the physiological effect of gibberellin. 2. On the interaction of gibberellin with auxins and growth inhibitors.** *Physiol. Plant.* 1958, **11**, No. 1, 10–15, bibl. 3. [Bot. Dep., Kyoto Univ., Japan]

1733 PURVES, W. K. and HILLMAN, W. S. **Response of pea stem sections to indoleacetic acid, gibberellic acid, and sucrose as affected by length and distance from apex.** *Physiol. Plant.* 1958, **11**, No. 1, 29–35, bibl. 13. [Bot. Dep., Yale Univ., New Haven, Connecticut]

1734 NIELSEN, N. and BERGQVIST, G. **The stimulation of the respiration of seeds with gibberellic acid and its analytical application.** *Physiol. Plant.* 1958, **11**, No. 2, 329–31, bibl. 1. [A/B Kabi, Stockholm]

Seeds of barley, wheat, timothy [*Phleum pratense*], rape and peas were soaked for 48 hr. in water or in solutions of 1, 3, 10, 30 or 100 ppm. gibberellic acid. After soaking, the seeds were transferred to glass containers, through which air, free from CO_2, was blown. CO_2 evolved by respiration of the seeds was absorbed by soda lime and measured over periods up to 50 hr. after the end of the soaking treatment. GA stimulated respiration in all cases, though only slightly with rape. Barley and wheat showed considerable response. It was thought that such respiration determinations would be of use for assaying amounts of 0·5–3 ppm. GA ; barley seed was particularly suitable for this purpose, as slight increases in the concentration of GA over the range 0–3 ppm. resulted in considerable increases in respiration.—P.J.B.

NUTRITION

1735 RIJVEN, A. H. G. C. **Effects of some inorganic nitrogenous substances on growth and nitrogen assimilation of young plant embryos *in vitro*.** *Aust. J. biol. Sci.* 1958, **11**, No. 2, 142–54, bibl. 17. [Div. Pl. Industry, C.S.I.R.O., Canberra]

1736 HUMPHRIES, E. C. **Entry of nutrients into the plant and their movement within it.** *Paper read at meeting of Fertilizer Soc., London, Jan. 1958*, 1958, pp. 30, bibl. 25.

The mechanisms of ion uptake by roots, viz. diffusion, ion exchange and " active transport " are discussed. The phenomenon of salt respiration is mentioned and its relation to Lundegardh's electrical theory of salt accumulation, involving the cytochrome system, is considered. Other more generalized theories of carrier systems are discussed. Data are given on the uptake of N, P and K by barley roots in liquid culture. The rate of uptake of each element was determined by : the concentration of that element in the root cells ; the concentration of carbohydrates, particularly reducing sugars in the root, influenced by light and the stage of growth of the plant ; and the external concentration of the element. The difference in the cation-exchange capacity of mono- and dicotyledons and its effect on the relative uptake of K by grasses and legumes in soils low in exchangeable K is discussed. Work on the uptake of nutrients by leaves is reviewed and the cases in which foliar spraying of nutrients is useful are summarized. These are generally restricted to those where soil application is not practicable. The transport of mineral elements in the plant and the resulting effects on the mineral composition of the various organs are discussed.—A.M.H.

1737 VAN SCHOOR, Germaine H. J. Les relations entre la composition élémentaire de la plante et son alimentation. [**The relationship between the elementary composition of the plant and its nutrition.**] *Ann. Physiol. vég. Univ. Brux.* 1957, **2**, No. 2, 7–424, bibl. 170, illus.

This study results from many experiments, carried out with several plant species, including cotton and maize, to investigate the relationship between the chemical composition of the plant and that of its nutritive medium. Among the general conclusions reached is that the composition of whole plants is practically invariable with regard to the anions but is dependent on the composition of the nutritive medium with regard to the cations. The composition of seeds is practically invariable with regard to both groups. For determining the cations a sample of adult leaves is best, and for the anions, a sample of adult stems. The importance is stressed of wild indicator plants which can be analysed, instead of crops, for obtaining information on the chemical composition of the soil.—E.B.O.

1738† VAN ALPHEN, T. G. Bespuiting met mangaan op verschillende gewassen. **Spraying crops with manganese.** *Lit Overzicht 17 Cent. LandbDocumentatie* 1956, pp. 43, bibl. 104, English summary. [TNO Agric. Exp. Sta. and Soil Sci. Inst., Groningen] [Received 1958]

Investigations since 1883 and the literature from 1902 are reviewed. Research in the Netherlands is first dealt with, then research in other countries. The review outlines Netherlands and foreign findings on Mn deficiency and its amendment in relation to certain crop plants, viz. sugarbeet, potatoes, peas, beans, oats, wheat and grasses. —G.M.R.

TECHNIQUES AND APPARATUS

1739† BRANDT, C. S. and LAZAR, V. A. **Plant**

analyses. Analysis of dried plant material by X-ray emission spectrograph. *J. agric. fd Chem.* 1958, **6**, No. 4, 306–9, bibl. 12. [U.S. Plant Soil and Nutrition Lab., Agric. Res. Serv., U.S. Dep. Agric., Ithaca, New York]

A method is described for the quantitative and semi-quantitative analysis of dried, ground plant material, which does not involve concentration or ashing.—P.J.B.

1740† Beley, J. and Cuemji, G. Dosage du magnésium dans les cendres végétales d'origine tropicale. [**Magnesium determination in plant ash of tropical origin.**] *Agron. trop., Nogent* 1958, **13**, No. 1, 116–19, bibl. 9.

A new method is proposed.—E.B.O.

1741† Brown, R. S. **Report on boron in plants.** *J. Ass. off. agric. Chem., Wash.* 1958, **41**, No. 2, 304–7, bibl. 11. [Ontario Agric. Coll., Guelph]

Three methods for determining the B content of plants were compared. They were : (a) the quinalizarin method, as modified by MacDougall and Biggs, (b) the curcumin method, and (c) the dianthrimide method. Method (a) was considered the most simple and convenient and was recommended for adoption by A.O.A.C.—P.J.B.

1742† Yuan, T. L. and Fiskell, J. G. A. **Dithizone and zincon procedures for zinc in plants : separation of interfering elements by ion exchange resins.** *J. Ass. off. agric. Chem., Wash.* 1958, **41**, No. 2, 424–8, bibl. 9. [Univ. Florida, Gainesville]

1743† Volk, R. J. and Weintraub, R. L. **Microdetermination of silicon in plants.** *Anal. Chem.* 1958, **30**, No. 5, 1011–14, bibl. 10. [Chemical Corps Biol. Warfare Lab., Fort Detrick, Frederick, Maryland]

A modified spectrophotometric technique is proposed for determining amounts of silicon of the order of 0·1 to 10% in 25 mg. plant-tissue samples. The method was primarily evolved for analysing individual leaves of rice plants.–P.J.B.

1744† Kick, H. and Arent, H. Zur Bestimmung des Germaniums in Pflanzenmasse. [**Determination of germanium in plant material.**] *Z. PflErnähr.* 1958, **81**, No. 2, 153–7, bibl. 8. [AgrikChem. Inst., Univ. Bonn, W. Germany]

A method for determining small quantities of Ge in plants is described. The procedure is relatively short because it omits the distillation process. The dry plant material is incinerated at 800°C. and the ash is allowed to combine with CaO at this temperature. Ge is recovered by immediately passing the compound through a separating funnel containing CCl_4 and HCl. After a single shaking Ge comes through with the CCl_4 and is not contaminated with other ions. The loss of Ge, which is usually high by other methods owing to the volatility of some of its compounds, is kept to a minimum by the (relatively) low temperature of the incineration.—D.B.

1745† Prikladov, N. V. [**A new means for determining moisture in seed.**] [Russian] *Selek. Semenovod.* (*Breeding and Seed Prod.*) 1958, **23**, No. 3, 56–9, illus.

A hygrometer (constructed in the Seed Laboratory, Sibirsk Botanical Garden, Tomsk University) is described and illustrated. It is claimed that by its use (it weighs about 400 g. and can be used in the field during harvest) moisture determination of a sample can be recorded in 2–3 min.—M.H.

1746† Crowder, J. P. and Schmeling, B. V. **A device for seeding greenhouse flats.** *Weeds* 1958, **6**, No. 1, 59–60, illus. [Virginia-Caroline Chem. Corp., Richmond, Virginia]

A description is given of a device for ensuring an even distribution when sowing small seeds in greenhouse flats.—P.J.B.

1747† Dore, W. G. **A simple chemical light meter.** *Ecology* 1958, **39**, No. 1, 151–2, illus. [Canada Dep. Agric., Ottawa, Ontario]

This apparatus makes use of the property of anthracene in benzene solution to polymerize into insoluble dianthracene on exposure to sunlight. A saturated solution is exposed to light in glass tubes, and the amount of anthracene remaining in solution after exposure is measured by means of a spectrophotometer. The rate of weakening of the anthracene solution follows a logarithmic curve; tubes of solution can be calibrated for a number of exposures against a standard light meter and a graph can be constructed from which further light-intensity readings can be made direct.—R.B.

1748 Spoelstra, P. A. De klimaatkassen van the I.B.S. **The air-conditioned glasshouses of the Institute for Biological and Chemical Research on Field Crops, Wageningen.** *Jaarb. Inst. biol. Scheik. Onderz.* 1957, 131–9, illus., English summary.

A description is given of a glass-house without windows. Air can be conditioned in a room under the central table and can be vertically injected into the glass-house compartments through two air ducts running the whole length of the side walls. The conditioning rooms contain heaters (warm water from central heating) and a cooling-system with well-water (temp. 10°–12°C., capacity 8000 l./hr.) or mechanical cooling. Air humidity can be raised by spraying water through nozzles in the air ducts. The roofs can be sprayed with water, no screens are used. In this way all shading constructions are avoided. Heating, cooling and humidity are automatically controlled. Light transmittance

is 78% compared with 61% in a glass-house of traditional construction. F.S.—G.M.R.

RADIOBIOLOGY

1749† Zhezhel, N. G. **Effect of natural radioactive substances on the yield of agricultural crops.** *Conf. Acad. Sci. USSR Peaceful Uses of Atomic Energy 1955, Div. Biol. Sci.* (English trans. by U.S. Atomic Energy Comm.) 1956, 101–6, bibl. 5.

The potentialities for employing radioactive substances to increase crop production, were investigated in pot, field and farm trials over 9 years using a Leningrad shale in comparison with uranium and radium salts over a wider range of soil and climatic conditions. The addition of appropriate dosages of these radioactive substances to soils exerted immediate and considerable after-effects, persisting for a number of years. With higher dosages, unfavourable responses were recorded. Plants differ in the quantities of radioactive substances needed to stimulate productivity and the effectiveness of the stimulant is conditioned by the availability of other plant nutrients in adequate quantities, the natural radioactivity of the soil itself, the biological peculiarities of the plant species and by the time and manner of supplementation. For many crops the optimal doses lie within 10^{-12} to 10^{-9} curie/kg. of soil but in other cases such as potatoes, cabbage and turnips, yields progressively increased with uranium doses from 10^{-5} to 10^{-3} curie/kg. soil. Plants are listed showing high [20–40%], medium [10–20%] and weak [less than 10%] responses and in 182 production trials covering 1668 ha. the favourable action of shale was demonstrated. In these trials, increases of 5–95% were recorded, and, as in smaller trials, the greatest increases were obtained with potatoes, cabbages and barley, particularly on fertilized podzolized soils of the non-chernozem belt.—M.H.F.

1750† Vlasyuk, P. A. **The effect of nuclear radiations on plants.** *Conf. Acad. Sci. USSR Peaceful Uses of Atomic Energy 1955, Div. Biol. Sci.* (English trans. by U.S. Atomic Energy Comm.) 1956, 89–99, illus., bibl. 10.

Natural ionizing radiations are components of the plant environment and studies of nuclear radiations have been conducted against the background of the need for increased plant productivity. To test the practical possibilities of using isotopes so that radioactivity did not accumulate in the tissues, seeds were treated prior to sowing with salts of rapidly decaying radioactive isotopes in amounts varying from 0·01 to 100 μC per kg. to give irradiation doses of $3{\cdot}1 \times 10^{-5}$ to 3·55 gram-roentgens. Plant responses to ionizing radiations fall into two phases, (a) either a rapid stimulation or a retardation of physiological functions, followed by (b) a restoration of normal processes. Reaction responses to nuclear radiations depend on nutrition, temperature and other external factors and may be regarded as a background irritant to the functional mobility of the plant favouring increased utilization of existing nutritional conditions, intensified metabolism and so increased productivity. The effects of ionizing radiations were greatest on the more highly cultivated plants and were always accompanied by an increase in sulphohydryl compounds (glutathione), possibly as a protective adaptation to irradiation. They also stimulated ascorbic acid, carotinoid and growth-activating substances. Field- and vegetative- studies with wheat, sugar-beet, maize, lupins and potatoes, using ^{32}P, ^{35}S, ^{45}Ca, ^{60}Co and ^{65}Zn from 1950–4, demonstrated the potentialities under practical conditions.—M.H.F.

1751 Nilan, R. A. **Factors governing plant radiosensitivity.** *U.S. Atomic Energy Comm. Rep. TID 7512, Conf. Radioact. Isot. in Agric.* 1956, 151–62, bibl. 97. [Washington Agric. Exp. Sta., Pullman] [Received March, 1958]

This review deals with the effects of γ-rays, X-rays and neutrons on plant tissues. Plants with large chromosomes such as *Vicia* spp. were more sensitive to chronic γ-radiation than plants with small chromosomes. *V. faba* and *Gossypium hirsutum* were extremely sensitive to γ-rays, *Linum usitatissimum* and *Brassica oleracea* were relatively resistant. Seeds of *Arachis hypogaea* were relatively sensitive to X-rays, and seeds of *L. usitatissimum* were relatively resistant. Aged seeds were more sensitive to X-rays than younger seeds. In barley and some other plants, factors enhancing X-ray damage to seeds were : soaking prior to irradiation, germination, very low water content, temperatures between 0 and 20°C. ; presence of O_2, CO_2, KCN, H_2O, colchicine or uranyl nitrate. Factors reducing damage were : dormancy, cooling with solid CO_2 or liquid air, sub-lethal heat treatment, O_2 shortage, NaCN, $Na_2S_2O_7$, and many compounds containing sulphydryl groups, including H_2S. Storage of irradiated seed for 1–9 weeks at room temperature increased seedling injury in barley and other plants. Damage was more severe with increased O_2 and less severe with increased N_2 and in storage at 3°C. Polyploid seeds of wheat, maize, barley and rye could survive heavier doses of irradiation than could diploids. By contrast, thermal neutrons caused less injury to tetraploids of wheat and oats than to diploids and hexaploids. Neutron damage to barley grain was much less affected by moisture, O_2 and H_2S than was X-ray damage.—R.B.

1752† Turchin, F. V. and others. **Study of the nitrogen nutrition and metabolism of**

plants with the use of the ^{15}N isotope. *Conf. Acad. Sci. USSR Peaceful Uses of Atomic Energy 1955, Div. Biol. Sci.* (English trans. by U.S. Atomic Energy Comm.) 1956, 145–54, bibl. 10.

1753† Skok, J. **Relationship of boron nutrition to radiosensitivity of sunflower plants.** *Pl. Physiol.* 1957, **32,** No. 6, 648–58, bibl. 14, illus. [Div. Biol., Med. Res., Argonne Nat. Lab., Lemont, Ill.]

Seven-day-old seedlings of *Helianthus annuus* var. Mammoth Russian were grown in nutrient solutions with or without B, for 2–5 days, and then irradiated with X-rays of 100–5000 r. and again supplied with B. Withholding B for short intervals prior to irradiation with doses which normally produced radiation symptoms had a markedly alleviating effect on injury. The absence of B rendered the plant more radiation resistant. The normally radiation-sensitive phase of cellular activity, which is B-dependent, appeared to be that of cellular maturation rather than cell division. F.s. —M.P.

1754† Middleton, L. J. **Absorption and translocation of strontium and caesium by plants from foliar sprays.** *Nature, Lond.* 1958, **181,** No. 4619, 1300–3, bibl. 7. [ARC Radiobiological Lab., Grove, Wantage, Berks]

In a general study of these fission products (considered to present the major hazard to consumers of crops) experiments were made with wheat, potatoes, swedes and sugar-beet, among others, by which ^{89}S and ^{137}Cs were sprayed on the plants at different growth phases. The data show, for example, that the deposition of ^{89}S on an immature grain resulted in a relatively high content of the element in the grain compared with plants sprayed before the ear emerged. It is maintained that during rainfall much of the contaminating element is washed off and that leaves with a waxy surface may thereby be partially protected. [N.B. Absorption through the roots after being washed off the leaves is not considered.] —M.H.

1755† Gorham, E. **Accumulation of radioactive fall-out by plants in the English Lake District.** *Nature, Lond.* 1958, **181,** No. 4622, 1523–4, bibl. 1. [Freshwater Biol. Assoc., Ambleside, Westmorland]

This study of natural and cultivated vegetation shows that plants with low ash content now exhibit 50-fold more radioactivity (compared with the decade prior to 1947) than those with a large mineral intake. This is to be expected because plants with low ash content generally grow on the more acid soils where fall-out constitutes a greater proportion of the adsorbed elements. It is claimed that the radioactivity in the present vegetation is due to fall-out from nuclear explosions and not to the Windscale accident. The high concentration of ^{90}S in the bones of upland sheep is attributed to the reliance of the sheep on the contaminated fodder plants.—M.H.

WEEDS AND WEED CONTROL

Where weeds are specific to a crop, see under the crop concerned. See also Abs. 1854, 1855

1756 Rothamsted Experimental Station. **Weed studies. Wild oats.** *Rep. Rothamsted Exp. Sta. 1957,* Harpenden, 1958, pp. 316, 1 map.

Many seeds of *Avena ludoviciana* were fully developed and dormant 15 days after anthesis. The % viable and dormant seeds increased from the 15th to the 25th day. Dormancy was lower in the 1st than in the 2nd seeds of the spikelets, reaching a maximum for 1st seeds of 80% at 25 days after anthesis, when all 2nd seeds were dormant. Tests of seeds of *A. ludoviciana,* which had lost their primary dormancy during 7 years' storage, showed that exposure to 23° or 25°C. did not induce dormancy in 1st seeds, but very few seeds germinated at 27°C. 25% of 2nd seeds became dormant at 25°C. and 4% at 23°C. Germination of 2nd seeds at 23° and 25°C. was increased by exposure to 7°C. for 1–7 days, but was not as high as that of seeds held continuously at 7°C. Stubble-burning stimulated germination of *A. fatua* in a badly-infested field ; there were about 10 times more plants per unit area in burnt than unburnt patches. However, in the soil beneath burnt patches there were still 10 dormant seeds for each one that germinated. [See also Abs. 1843.]—A.M.H.

1757 Kommedahl, T. and others. **Factors affecting dormancy and seedling development in wild oats.** *Weeds* 1958, **6,** No. 1, 12–18, bibl. 12. [Minnesota Agric. Exp. Sta., St. Paul]

The tests reported were made on 32 lots of wild oat grain derived from 21 locations in N. Dakota, 8 in Minnesota and 3 in Montana and all appeared to consist of *Avena fatua* var. *intermedia.* Hull colour (dark or light) was not correlated with germination. The germination percentages of large grains averaged 50, compared with 28·5 for small grains. The germination of grains with the hulls removed averaged 71%, compared with 35% for those with intact hulls. The germination of grain soaked for 1 hr. in water under partial vacuum, so as to remove air from under the hull, was greatly reduced (7%) ; that of de-hulled grain similarly treated was 49%. Subjecting grain to wetting and re-drying treatments markedly reduced germination both in soil and on Petri dishes, indicating that secondary dormancy may have been

induced. The germination of grain coated with ground, dark-coloured hull material after 3 days was much lower than that of de-hulled grain, but not so low as that of grain with intact hulls ; after 10 days, the differences between the germination percentages of de-hulled grains and those of grains coated with hull material, regardless of colour, were negligible. There was evidence that aqueous extracts of dark-coloured hull material inhibited germination. It could not clearly be established whether dormancy in wild oats was attributable to substances normally present in the seed hulls, or whether toxic substances from the microflora within the hulls affected germination.—P.J.B.

1758 Bylterud, A. Resultater av TCA-behandling mot kveke i praksis. [**The results of TCA treatments to control couch.**] *Særtrykk 24 Stat. Plant. Ugrasbiol. Avd., Vollebekk, Norway* 1958, pp. 10.

The results are given of over 60 trials during 1955–7 on farms in east Norway, in which TCA (usually 20–30 kg. TCA/ha.) was applied either in autumn or spring to control *Agropyron repens*. 20–25 kg. TCA/ha. appeared to give the best results. A rainfall of 40–60 mm. in April appeared to give the best results ; 20–30 mm. appeared to be too small to ensure good distribution of TCA in the soil. Applying TCA as early as possible in spring, even before frost had left the ground, gave the best results. Deep ploughing, followed by levelling the soil, during the previous autumn was advisable. Crops that could safely be grown following TCA treatment included : marrow-stem kale, swedes, turnips, rape, turnip-rape, beet, carrots and the potato varieties Kerr's Pink, King George, Alpha and Prestkvern. The potato varieties Saga, Marius II and Åspotet and peas were not sufficiently tolerant to be grown safely after TCA treatment. It was advisable to grow crops which provided opportunities for weed eradication by row cultivation, as kills of the order of 90%, only, could be secured by using TCA alone.—P.J.B.

1759 Bruns, V. F. and Rasmussen, L. W. **The effects of fresh water storage on the germination of certain weed seeds. 3. Quackgrass, green bristle grass, yellow bristlegrass, watergrass, pigweed, and halogeton.** *Weeds* 1958, **6**, No. 1, 42–8, bibl. 3. [Irrigation Exp. Sta., Prosser, Washington].

Samples of the seed of 6 weed species were submerged at depths of 12 and 48 in. in a canal and removed at 3-month intervals over a 33-month period and subjected to germination tests. Less than 1% of watergrass (*Echinochloa crus-galli*) and halogeton (*Halogeton glomeratus*) (black seeds) germinated after 3 months and none after 12 months' submergence. Less than 1% of yellow bristle grass (*Setaria lutescens*) and not more than 3% of quackgrass (*Agropyron repens*) seed germinated after 3 months, but none after 27 months' submergence. After 15 months' submergence, less than 10% of green bristlegrass (*Setaria viridis*) seed germinated and none after 30 months. After 33 months' submergence, 9% of pigweed (*Amaranthus retroflexus*) seed still germinated. F.S.—P.J.B.

1760† Meadly, G. R. W. **Weeds of Western Australia. Ragwort** (*Senecio jacobaea* **L.**). *J. Dep. Agric. W. Aust.* 1958, **7**, No. 2,165–7, illus.

Control can be obtained by thorough grubbing or by 2 consecutive years' cropping of infested land, followed by sowing with vigorous pasture spp. Treatment with 5% sodium chlorate or spot-spraying with 2,4-D ester (1·5–2 lb. a.e./ac. for seedlings or 4 lb. a.e./ac. for established plants) are also effective.—A.M.H.

1761† Puckridge, D. W. **Weeds of South Australia. South African daisy** (*Senecio pterophorus* **D.C.**). *J. Dep. Agric. S. Aust.* 1958, **61**, No. 9, 431–2, illus.

Isolated plants should be grubbed or hand-pulled before flowering. *S. pterophorus* is not killed by hormone weedkillers, but small patches may be controlled by $NaClO_3$ or arsenical weedkillers. Cultivation kills established bushes, but promotes vigorous seedling growth. Rotary slashing of the plants, preferably in summer, is recommended and must be continued over several seasons.—A.M.H.

1762 Hodgson, J. M. **Canada thistle** (*Cirsium arvense* **Scop.**) **control with cultivation, cropping and chemical sprays.** *Weeds* 1958, **6**, No. 1, 1–11, bibl. 12, illus. [Montana Agric. Exp. Sta., Bozeman]

Plots in Montana, carrying an established stand of *Cirsium arvense*, were subjected to 16 different cropping systems, in combination with 2,4-D and cultivation treatments, over a 4-year period. All treatments involving the use of 2,4-D resulted in substantial reductions in *C. arvense* stands. Two treatments resulted in complete control. The first was as follows : 1st year, cultivation with a duck-foot sweep at a depth of 3–4 in. every 21 days ; 2nd year, spring wheat, with 2,4-D (0·75 lb. ester/ac.) treatment when *C. arvense* was at the early-bud stage, and ploughing immediately after harvest ; 3rd year, as for 1st year ; 4th year, as for the 2nd year. The second was : 1st year, potatoes cultivated twice between rows with 1 lb. 2,4-D/ac. applied 2 weeks before harvest ; 2nd, 3rd and 4th years, maize for silage sown after one spring cultivation, with 1 lb. 2,4-D triethanolamine salt/ac. applied when the maize was 8–12 in. high, followed by ploughing in autumn after harvest. Cultivating every 21 days for one season, alone, resulted in an almost complete control of *C. arvense* stands, while spraying

spring wheat with 0·75 lb. 2,4-D ester/ac. for 4 successive years resulted in 99% control. Combining N treatments with the 2,4-D had no apparent effect on the kill of *C. arvense*. 2,4-D was more effective when used in combination with competing crops than when used alone.—P.J.B.

1763 PHILLIPS, W. M. and LAUNCHBAUGH, J. L. **Preliminary studies of the root system of *Kochia scoparia* at Hays, Kansas.** *Weeds* 1958, **6**, No. 1, 19–23, bibl. 6, illus. [Fort Hays Branch Agric. Exp. Sta., Kansas]

1764 TASMANIAN JOURNAL OF AGRICULTURE. **Cape tulip.** *Tasm. J. Agric.* 1958, **29**, No. 1, 53–6, illus.

The poisonous one-leaf Cape tulip (*Homeria collina*) is described together with control measures such as grubbing, followed by cultivation, and the use of hormonal herbicides.—M.H.F.

1765 AMANN, F. Untersuchungen über die Bekämpfung des Franzosenkrautes (*Galinsoga parviflora Cavanilles*) in Hackfrucht- und Gemüse-Kulturen, insbesondere mit Kalkstickstoff und Hederich-Kainit. [**Control of gallant soldier (*G. parviflora Cavanilles*) in root- and vegetable-crops, especially with calcium cyanamide and Hederich-kainit.**] *Thesis, Landw. Hochsch. Hohenheim* 1956, pp. 90, bibl. 31. [Stuttgart-Hohenheim, W. Germany] [Received April, 1958]

1766 LYRE, H.-H. Beiträge zur Biologie und Ökologie der Vogelmiere, *Stellaria media* (L.) Cyr. [**The biology and ecology of chickweed, *Stellaria media* (L.) Cyr.**] *Thesis, Landw. Hochsch., Hohenheim* 1957, pp. 70, bibl. 13. [Stuttgart/Hohenheim, W. Germany]

1767 SHAFER, N. and MONSON, W. G. **The role of gibberellic acid in overcoming bud dormancy in perennial weeds. 1. Leafy spurge (*Euphorbia esula* L.) and ironweed (*Vernonia baldwini* Torr.).** *Weeds* 1958, **6**, No. 2, 172–8, bibl. 6, illus. [Nebraska Agric. Exp. Sta., Lincoln]

GA was applied either as a foliage spray or in lanolin paste to leafy spurge and ironweed in an attempt to activate dormant buds. With ironweed, no response was noted. Applications of lanolin paste made to dormant buds of leafy spurge were more effective than aqueous sprays in overcoming dormancy. Where top growth was removed before treatment, both methods of treatment were equally effective. Spraying the intact foliage of leafy spurge resulted in most activation of dormant buds. The effects of GA were similar to those associated with the removal of apical dominance, but the growth rate resulting from GA treatment was several times greater. Increasing the conc. of GA from 25 to 500 ppm. increased plant response. No consistent effect of GA on floral induction was noted. F.s.—P.J.B.

1768 VASIL'EV, D. C. [***Ambrosia artemisiifolia* in the Krasnodar Territory.**] [Russian] *Vestn. sel'skohoz. Nauki (J. agric. Sci., USSR)* 1958, **3**, No. 5, 135–6.

This weed is widely dispersed in many southern areas of the Soviet Union. The seed has a prolonged period of after-harvest ripening. The author's tests (carried out during 1954–7, at VNIIEMK, [All-Union Sci. Res. Inst., Oil Crops]) were designed to elucidate the factors which affect this period and to formulate control measures. It is concluded that conditions in the soil are the most favourable (compared with storage in a barn or laboratory) for after-harvest ripening, which takes 4–5 months. The average air °T. for germination in spring under field conditions is 9 or 10°C. In the southern and central districts of the Krasnodar region, fields infested with the weed should be cleaned by tillage and then sown with *Helianthus annuus* during the 3rd week of April, or with maize in the second week of May.—M.H.

1769† NARAYANAN, T. R. and THYAGARAJAN, N. M. **Making short work of lantana.** *Indian Frng* 1958, **8**, No. 1, 14. [Agric. Res. Sta., Ambalavayal, and Fruit Res. Sta., Kallar]

The best means of eradicating *Lantana camara*, a weed which has become rampant on the Western Ghats up to an altitude of 6,000 ft., is to prune the shrubs to a height of 2 ft. and apply 2,4,5-T at 20 lb./ac. in a spray volume of 150 gal./ac., using teepol as wetting agent. Treated plants withered in 15 days.—D.B.

1770 NELSON, R. R. **The effect of soil type and soil temperature on the growth and development of witchweed (*Striga asiatica*) under controlled soil temperatures.** *Pl. Dis. Reptr* 1958, **42**, No. 1, 152–5, bibl. 7. [N. Carolina Agric. Exp. Sta., Raleigh]

S. asiatica, grown in a greenhouse with *Sorghum halepense* and maize as host plants, developed to maturity on most soils tested at a soil temperature of 32°C. Plants were able to emerge in light sand at 18°C., but required temperatures of 25°C. for flowering in such soils. The temperature requirements for emergence and flowering tended to rise as the soils tested became heavier. Soil type and soil temperature appear to be important limiting factors in the spread of *Striga*. It is thought that this weed could become a problem if introduced into certain areas of south-western USA.—P.J.B.

1771 CHANCELLOR, A. P. **The control of aquatic weeds and algae.** 1958, pp. 19, bibl. 16 and in text, London : H.M.S.O., 2s. 6d. [A.R.C. Unit of Exp. Agron., Univ. Oxford]

Mechanical and chemical control measures are discussed. Methods for the application of chemicals and the special precautions necessary in treating aquatic habitats are described. Efficiency in controlling aquatic vegetation and their toxicity to fish, livestock and man are discussed for the following chemicals : sodium arsenite, monuron, 2,4,-D, MCPA, TCA, $NaClO_3$, dalapon, $CuSO_4$ and 2,3-dichloronaphthoquinone.—A.M.H.

1772 Baker, O. L. and others. **Weed control in Montana.** *Circ. 210 Montana Agric. Exp. Sta.* 1956, pp. 36.

1773 Sijtsma, R. Enige resultaten van het onderzoek naar de selectiviteit van herbiciden. [**Some results of the study of selectivity in herbicides.**] *Rep. Ex. Fm "De Bouwing", Randwijk* [n.d.], 43–55. [Received 1958]

A detailed account is given of the results of using selective herbicides, with special reference to the stage at which the crop plants concerned are most resistant to the effects of the herbicide spray. The crops dealt with are winter- and summer-wheat, summer barley, oats, peas, lucerne, red- and white-clover.—G.M.R.

1774 Frans, R. E. **Kinetics of herbicidal action.** *Iowa State Coll. J. Sci.* 1957, **31,** No. 3, 412–3. [Received May, 1958]

The results are given of a kinetic analysis of growth inhibition in relation to molecular reactions in plants, using soyabeans. Herbicides used included : 2,4-D, 2,4,5-T, ATA, dalapon, TCA, IAA and MH.—P.J.B.

1775 Fang, S. C. **Absorption, translocation and metabolism of 2,4-D-1-C^{14} in pea and tomato plants.** *Weeds* 1958, **6,** No. 2, 179–86, bibl. 7, illus. [Oregon State Coll., Corvallis]

1776 Holstun, J. T. **Phytotoxicity and reactions of 2,2-dichloropropionic acid.** *Iowa State Coll. J. Sci.* 1957, **31,** No. 3, 443. [Received May, 1958]

1777 Sheets, T. J. and Leonard, O. A. **An evaluation of the herbicidal efficiency of combinations of ATA [amino triazole] with dalapon, monuron and several other chemicals.** *Weeds* 1958, **6,** No. 2, 143–51, bibl. 12.

Test crops used included barley and *Echinochloa crus-galli* and 'other chemicals' used were Cl-substituted and unsubstituted carboxylic acids.—P.J.B.

1778 Upchurch, R. P. **The influence of soil factors on the phytotoxicity and plant selectivity of diuron.** *Weeds* 1958, **6,** No. 2, 161–71, bibl. 12. [N. Carolina Agric. Exp. Sta., Raleigh]

Crops used included cotton and Italian ryegrass [*Lolium multiflorum*].—P.J.B.

1779 Vlitos, A. J. and Hitchcock, T. S. **Plant growth regulating activity of 3-indole-methanesulfonic acid.** *Contrib. Boyce Thompson Inst.* 1958, **19,** No. 3, 255–65, bibl. 8.

The results are given of bioassays of the growth-regulating activity of IMSA. In experiments to determine its activity as a herbicide, post-emergence treatment with IMSA at 10 or 20 lb./ac. gave good control of both grass and broad-leaved weeds in stands of soyabeans, oats and maize ; the soyabeans were severely injured, while oats and maize were but little affected. Compared with IAA, IMSA produced persisting effects on the growth of certain tissues in susceptible plants and is regarded as of potential value as a selective herbicide.—P.J.B.

SURVEYS AND LAND USE

SURVEYS

1780† Benier, C. Considérations générales sur l'économie agricole marocaine. [**General considerations on the agricultural economy of Morocco.**] *Terre maroc.* 1958, **32,** No. 341, 133–9.

1781† Fatis Review (OEEC). **Aspects of Turkish agriculture.** *Fatis Rev.* 1958, **5,** No. 2, 46–9, illus.

1782† Mick, A. H. **Arctic and subarctic agriculture.** *Oregon State Coll. 18th Ann. Biol. Colloq.* 1957, 100–9, bibl. 26, illus.

1783 Jones, R. G. B. **The application of air photo-analysis and interpretation to soil survey and land classification.** *Rhod. Agric. J.* 1958, **55,** No. 2, 195–201, bibl. 14. [Cent. Afr. Fed. Dep. of Conservation and Extension]

1784 Cabral, A. L. Recenseamento agrícola da Guiné. Estimativa em 1953. [**Agricultural census of Portuguese Guinea. Estimate for 1953.**] *Bol. cult. Guiné portug.* 1956, **11,** No. 43, 7–243, English and French summaries. [Received May, 1958]

1785† FAO. **Report on the 1950 world census of agriculture. Volume 1. Census results by countries. Checklist No. 3.** Rome, 1955.

[See Abs. 760.] The countries considered in this instalment are : Australia ; Austria ; Bechuanaland ; Cook and Niue Islands ; Cyprus ; Dominican Republic ; Guatemala ; Hungary ; Ireland ; Israel ; Japan ; Kenya ; Luxembourg; Mauritius ; New Zealand ; Portugal ; Ryukyu Islands ; Southern Rhodesia ; Swaziland ; Sweden; Switzerland; Union of South Africa ; United Kingdom ; USA ; Western Samoa ; Yugoslavia. —E.B.O.

LAND USE

1786† Land Development Board (Non-Scheduled Areas). **African Land Development in Kenya. July 1956-June 1957.** Nairobi, [n.d.], pp. 56, illus., 1 map. [Received June, 1958]

1787 Lima, R. R. A agricultura nas várzeas do estuario do Amazonas. [**The agriculture on the flat banks of the Amazon estuary (Brazil).**] *Bol. téc. 33 Inst. agron. Norte* 1956, pp. 164, bibl. in text, illus. [Received Apr., 1958]

This bulletin is concerned with the development of agriculture on the flat lands of the Amazon estuary which are daily flooded with river water (the volume of water which flows into the sea drives the salt water to a great distance from the coast). Results are given from 10 years' study, mainly to determine the best techniques for growing crops under these conditions. Information is given on the floods, and their sediment which maintains soil fertility. A relationship was found between the plant associations present and the agricultural value of the land. The various methods for clearing the land from its natural vegetation (mainly forest) are examined. As the soil is clay the dangers of burning are limited. After clearing, a new vegetation grows, mainly of Gramineae and Cyperaceae. Soil drainage is required. Information is given on crop behaviour in relation to soil level, rainfall distribution and tidal hours. The rice yield from the Amazon Region is 30,000–38,000 metric tons per year. In the area under study, conditions are excellent for rice-growing, average yields being 4500 kg./ha., without manuring, compared with 2500 kg./ha. in Rio Grande do Sul with irrigation and manuring. The best rice variety is Texas Patna from Louisiana. Maize does well in the higher areas where it can be grown for several years consecutively, yielding on average 1500 kg./ha. Early-maturing cassava also does well, the variety Mameluca yielding 17 tons of roots per ha. when 6 months old.—E.B.O.

LAND RECLAMATION

1788 Ministry of Agriculture, Fisheries and Food, Gt Britain. **The reclamation of derelict woodland for agricultural use.** *Tech. Rep. 1 Minist. Agric., Fish., Fd Agric. Land Service,* 1957, pp. iv + 32, illus. [Received March, 1958]

1. Methods for clearing derelict woodland, pp. 1–6. Method A involves the use of heavy bulldozers and a heavy bush plough. It is liable to cause undue disturbance and loss of topsoil. In method B explosives are used to crack the stumps, which are subsequently removed with a lifting-comb, causing minimum disturbance of the soil. Roots are removed with a heavy cultivator or rake.

2. Comparison of the cost and efficiency of the two methods, pp. 6–8. Comparison is difficult because of the large number of factors influencing the cost of reclamation of any particular site. Method B was usually cheaper and more efficient on light to medium land, but was more costly than Method A on heavy land. Gross costs of reclamation ranged from £24/ac. to over £100/ac. and net costs, after deducting grants, from £12–88/ac.

3. Value of reclamation, pp. 8–18. This is analysed in terms of the average yearly income from farming the reclaimed land, its increased rental value and its increased capital value.—A.M.H.

1789† Walsh, T. and others. **The use of peatland in Irish agriculture.** *Advanc. Sci.* **14,** No. 57, 405–16. [Dep. Agric., Republic of Ireland]

FARMING SYSTEMS AND PRACTICES

1790 Grassland Research Institute, Hurley. **Experiments in Progress, No. 10. Annual Report for 1956-7.** 1958, pp. 110, 7s. 6d.

1. Residual effects of ley management treatments on subsequent test crops, pp. 45–6. Test crops in successive years after ploughing were winter wheat, marrow-stem kale and barley. Effects on wheat yields were similar to those previously reported, viz., yields following grazed leys were significantly greater than after cutting ; subsequent wheat yields were increased by addition of N to grazed leys but reduced by addition of N to swards cut continuously ; yields were significantly less after ryegrass/clover than after cocksfoot/clover leys. Yields of marrow-stem kale were significantly greater after ryegrass than after cocksfoot swards. N fertilizer on the ley increased kale yield, except where the ley was cut and the herbage removed. The yield after a 3-yr. ley was greater than after a 1-yr. ley in the 4-course arable rotation. Barley yields in the 3rd yr. after the ley were significantly greater after ryegrass than after cocksfoot swards. The effect of N had largely disappeared, but the 3-yr. ley was still superior to the 1-yr.

2. The influence of leys on the soil, pp. 47–51. The development of water-stable aggregates was significantly greater under ryegrass than under cocksfoot swards, but there was no significant difference between other aspects of ley management. Grazing of the sward and application of N increased the amount of mineral N produced. This was highly correlated with following wheat yields. —A.M.H.

1791† Mann, H. H. and Boyd, D. A. **Some results of an experiment to compare ley and arable rotations at Woburn.** *J. agric. Sci.* 1958, **50**, No. 3, 297–306, bibl. 4. [Woburn Exp. Sta., Beds.]

The effect of short leys and arable cropping on yields of subsequent arable crops has been tested from 1937–56. The leys were a 3-yr. grazed ley and 3 yr. of lucerne cut for hay. Arable cropping was potatoes, winter cereal and a 1-yr. ley or a 3rd tillage crop (kale or sugar-beet). Test crops were potatoes and barley, uniformly treated except that half of each potato plot received 15 tons farmyard manure/ac. Without farmyard manure, the yield of potatoes after the grazed ley was *c.* 3 tons/ac. more than after 3 tillage crops ; after lucerne, *c.* 2 tons/ac. more than after tillage crops ; and after the 1-yr. ley 0·8 ton/ac. more. With farmyard manure, the benefit from leys was less (*c.* 2 tons/ac. for both lucerne and grazed ley). Farmyard manure increased yields by *c.* 2·8 tons/ac., except after the grazed ley where the increase was only 1·6 tons/ac. Effects of previous cropping on the yield of barley were small in the early years of the experiment, but in the last 5 yr., the yield after ley and lucerne exceeded that after tillage crops by 20% in plots not receiving farmyard manure and by 10% in those receiving farmyard manure. Differences in potato yields between ley and arable sequences are partly attributed to differential incidence of potato-root eelworm and the low level of basal manuring. F.s.—A.M.H.

1792† Aldrich, D. T. A. and others. **White clover trial. 6. Residual soil fertility.** *J. Brit. Grassl. Soc.* 1958, **13**, No. 2, 147–50, bibl. 7. [Wye Coll., Ashford, Kent]

Yields were recorded from a potato crop grown in the first year following a grazing trial comparing 4 strains of white clover [*Herb. Abstr.* 22 : 879 and 24 : 128]. The Kent clover strain, which was the most persistent and which had produced the greatest live-weight increase per ac., gave the highest yield of potatoes. The Dutch white clover, which had been the poorest in the grassland trial, gave the lowest yield of potatoes. A $2\times2\times2$ N, P, K fertilizer design was superimposed in the form of split plots. Nitro-chalk at 5 cwt. per ac. and muriate of potash at 2 cwt. per ac. both caused significant reductions in yield, and this was thought to be due to the exceptionally high soil fertility status of the field. The fertilizer × clover interactions were non-significant, and contributed little towards an explanation of the fundamental basis of the soil fertility differences caused by these 4 clover strains. F.s.—D.B.

1793† Gaponenkov, T. K. and others. **[The influence of annual plants on the accumulation of organic substances and on structure in soils.]** [Russian] *Zemledelie* (*Agriculture, USSR*) 1958, **6**, No. 1, 23–6. [Voronež Agric. Inst.]

It has been claimed that annual grasses are less satisfactory than perennial herbage plants in their beneficial effects on subsequent crops in a rotation. The authors studied the effect on soil fertility of a mixture of *Sorghum sudanense* and legumes (*Vicia* and *Pisum*). The tests were carried out in plots (250m.², 3 replications) on leached black-earth (5·5% humus). Among the data obtained there is evidence that a mixture of Sudan grass with the legumes [proportions not given] produces roots (in the horizon 0–40 cm.) having an air-dry weight (average for 2 years) of 4600 kg./ha. (vetch mixture), and 4900 kg./ha. (pea mixture), compared with 4100 kg./ha. for Sudan grass as a pure stand and 3800 kg./ha. for a mixture of *Agropyron* sp. and *Medicago sativa*.—M.H.

1794† Pätzold, H. Dreijährige Untersuchungen über die Nachfruchtwirkung von Rotklee,

verschiedenen Gräsern und Kleegrasgemischen. [**A 3-year investigation of the effect of red clover, several grasses and clover/grass mixtures on following crops in a rotation.**] *Z. Acker- u. PflBau* 1958, **105**, No. 1, 50–60, bibl. 29. [Inst. Acker- u. PflBau, Univ. Rostock, E. Germany]

The effect was determined of red clover, 6 single-grass/red-clover mixtures, 6 pure-sown grass species, and fallow on yields of swede, spring barley and winter rye grown as following crops in a rotation. During the first 2 years, the highest yields of following crops were obtained after red clover. The preceding-crop value of the pure-sown grasses and the grass/clover mixtures improved during the 2nd and 3rd years, and in the 3rd year, grass/clover, pure grass and fallow resulted in 7, 6 and 2% higher yields of following crops than were obtained after red clover. Taking the 3-yr. average, higher yields of following crops were obtained after red clover than after clover/grass, grass, or fallow. Meadow fescue, whether pure or in a grass/clover mixture, occupied an exceptional position in that it excelled red clover as a preceding crop in the 2nd and 3rd years and in the 3-yr. average. Red fescue alone or in a clover/grass mixture was a very poor preceding crop in the first year of the experiment, but by the third year, the following-crop yield was 20% higher than after red clover. The N-content, but not the weight, of roots was correlated with the preceding-crop value of red clover and grasses.—D.B.

1795 Warren, R. G. **The residual effects of the manurial and cropping treatments in the Agdell rotation experiment.** *Rep. Rothamsted Exp. Sta. 1957*, Harpenden, 1958, 252–60.

The experiment comprised 2 crop rotations, swedes/barley/clover (or beans)/wheat and swedes/barley/fallow/wheat, and 3 manurial treatments, O, P (PK since 1884) and NPK, applied every 4th yr. to the swede crops. The experiment was concluded in 1951 and the field was fallowed for 1 yr., after which it was cropped with cereals until 1955, receiving a uniform dressing of N only each year and differential chalk dressings on the more acid plots in 1953–4. Beans were grown in 1956 and potatoes in '57 to measure the residual effects of the PK treatments. For beans, the average increase in the PK and NPK plots was 14 cwt. grain/ac. and for potatoes, 8·5 tons tubers/ac. In 7 out of 8 comparisons between rotations, yields following the clover rotation were lower than those following the fallow rotation. Comparison of the P- and K-contents of potato tubers indicated that shortage of P, rather than K, was limiting in the areas used for the clover rotation. The effects of the treatments on the N-, P- and K-contents of the soil are discussed. [See also Abs. 1660.]—A.M.H.

1796 Thompson, M. J. **Studies on soil fertility and crop rotation at the Northeast Experiment Station, Duluth, Minnesota, 1916-1952.** *Tech. Bull. 220 N.E. Agric. Exp. Sta.* 1957, pp. 55, bibl. 47. [N.E. Agric. Exp. Sta., Duluth, Minn.]

1797† Larsen, P. H. Frøavlerens markplan. [**Rotations for seed growers.**] *Dansk Frøavl* 1958, **41**, No. 10, 181–4. [Landboskolen, Lyngby, Denmark]

The rationalization of crop-rotation systems in Denmark is discussed and 2 examples are given of schemes, one for a 50-ha. farm on good soil and the other for a farm without livestock, both embodying crops grown for seed.—P.J.B.

1798 Zingg, A. W. and Whitfield, C. J. **A summary of research experience with stubble-mulch farming in the Western States.** *Tech. Bull. 1166 U.S. Dep. Agric.* 1957, pp. 56, bibl. 31, illus.

Stubble-mulching reduced soil losses caused by heavy rainfall to 20% of those occurring with mouldboard ploughing. Average annual runoff was reduced by half. In semi-arid conditions, yields of wheat were slightly increased by mulching, while in more humid conditions yields were slightly decreased. Mulching slightly reduced yields of wheat straw, the grain-protein content and the ratio of straw to grain. N applications were more effective in increasing wheat yields on mulched than on unmulched surfaces. F.S.—R.B.

1799 Haylett, D. G. **Advances in crops and pastures in the Union of South Africa in the last twenty-five years.** *Emp. J. exp. Agric.* 1958, **26**, No. 102, 169–82, bibl. 99.

The greatest single factor which has changed the agricultural pattern in South Africa has been increasing mechanization. Advances in crops are dealt with under the headings of crop-production techniques, soils and fertilizers, and plant-breeding. Fallowing has been shown to be of no material benefit under summer-rainfall conditions and green-manuring to be uneconomic. Crop rotation with legumes was generally beneficial, especially the use of lucerne and lupins in the southern winter-rainfall area. Most of the work on soil-fertility has dealt with the fertilizer requirements of crops such as maize, wheat and other winter cereals, and irrigated lucerne.—A.M.H.

1800† Grootenhuis, J. A. De invloed van groenbemesting op de vruchtbaarheidstoestand van de grond op de drie miniatuur organische stofbedrijven in de N. O.-Polder in de jaren 1954 t/m 1956. [**The effect of green manuring on soil fertility on the three miniature organic-matter farms, North-east Polder, 1954-6 inclusive.**] *Bodem* 1957, pp. 19. [Inst. Soil Fertility, Groningen, Netherlands]

[For the organization of the 3 farms see *Fld*

Crop Abstr. 10 : 1683.] During 1954–6, potatoes and sugar-beet were grown either without N or with different levels of N fertilization, following : (a) 2-years' ley manured with f.y.m. or compost, (b) *Medicago lupulina* as a stubble crop grown for green manure, undersown in fibre flax or winter wheat, or (c) in a 6-course rotation of sugar-beet/oats/fibre flax/potatoes/peas/winter wheat. The three years of the trials had different weather conditions which affected the profit or loss from using synthetic fertilizers after green manure. In the wet years 1954 and 1956 it was unprofitable to apply even 100 kg. N per ha. to potatoes and sugar-beet after green manure. Long-term weather forecasts would be of great assistance in determining what doses of synthetic fertilizers to apply to different crops after green manure.—G.M.R.

1801† Rojas, M. E. Adaptabilidad de la *Sesbania* como abono verde en el país. [**Adaptability of *Sesbania* sp. for green manure in Peru.**] *Bol. trim. Exp. agropec., Lima* 1956, **5**, No. 4, 8–11, bibl. 1. [Esta. Exp. Agríc., La Molina, Peru] [Received Apr., 1958]

Information, including chemical composition, is given on *Sesbania* sp., which was introduced from Mexico into Peru.—E.B.O.

1802† Gaudefroy-Demombynes, P. Observations sur la couverture du sol. [**Observations on soil cover.**] *Bull. agron. Fr. d'out. mer* 1957, No. 15, 25–33, bibl. 5, illus. [Cent. Rech. Agron., Bambey, Senegal]

Trials with *Centrosema plumieri* as a cover crop for the dry season showed this plant to be remarkably drought-resistant and very effective both in reducing soil temperature and in protecting the microflora. Attention is drawn to other cover crops, viz. *Dolichos lablab*, *Stizolobium* sp., *Vigna sinensis*, *Citrullus vulgaris* and the grasses (as 2- or 3-year leys) *Cenchrus setigerus*, *C. ciliaris*, *Panicum antidotale*, *P. coloratum* and *Hyparrhenia hirta*.—G.M.R.

1803 Wood, D. **The provision of water for irrigation.** *World Crops* 1958, **10**, No. 6, 209–13, illus.

The relative merits of irrigation by surface waters, brought from distant sources, and by subsurface waters, pumped to the surface on site, are considered. The latter system is preferable whenever possible, in spite of higher running costs, because excessive losses of water by evaporation and soakage are avoided and initial capital costs are usually less.—A.M.H.

1804 Patil, N. P. **An inquiry into the economic effects of bunding in north Mysore.** *Mysore agric. J.* 1957, **32**, Nos. 3 and 4, 117–23. [Coll. Agric., Dharwar]

1805† McCulloch, A. W. **The economics of sprinkler irrigation systems.** *Australas. Irrigator* 1958, **3**, No. 5, 9-13. [W. R. Ames Co., Denver, Colorado]

1806 Nicholson, H. H. and Firth, D. H. **The effect of ground water-level on the yield of some common crops on a fen peat soil.** *J. agric. Sci.* 1958, **50**, No. 3, 243–52, bibl. 5. [Sch. Agric., Univ. Cambridge]

Further information is given on a field experiment to control the water-level in a fen peat soil and study its effects on the yield of crops in a 6-course rotation. [See *Fld Crop Abstr.* 6: 1093.] Deterioration of the physical condition of the soil over high water-levels was marked, particularly over levels within 20 in. of the surface, and was discernible over 30-in. levels. The trends shown by potatoes, kale and sugar-beet were similar to those previously reported. For potatoes, evidence favoured using high water-levels (20–25 in.) in dry seasons. For sugar-beet and kale, the trends favoured ground water-levels of 30–35 in. Under rye, high water-levels diminished blowing of the topsoil in spring and lodging of the crop. Wheat failed wholly or in part in every year, except 1948 and '53, and only yielded grain over high water-levels. Cu deficiency was confirmed in the soil under investigation.—A.M.H.

1807 Kreutz, W. and Walter, W. Windschutzwirkung in Abhängigkeit von der Breite und Durchlässigkeit des Hindernisses. (Nach Untersuchungen im Windkanal). [**The effect of a windbreak in relation to the width and openness of the barrier. Experiments in a wind tunnel.**] *Z. Acker- u. PflBau* 1958, **105**, No. 3, 271–82, illus. [Agrarmeteorologische Versuchs- und Beratungsstelle, Giessen, W. Germany]

1808† Oksenenko, I. A. [**Determination of sowing norms for seeds from a consideration of their size.**] [Russian] *Zemledelie* (*Agriculture, USSR*) 1958, **6**, No. 3, 31–2.

The absolute weight of seeds [wt. of dry matter in 1000 seeds] depends not only on variety of the crop, but also on weather conditions during growth and on cultural measures. The author's study of the barley variety Jubileĭnyĭ showed that in 1954, the 1000-grain weight [dry matter + hygroscopic water] was 35·4 g., in 1955 it was 53·2 g. and in 1956, 44·1 g. Sowing norms should be related to changes in the absolute weight of seed in different years. The following formula is postulated for calculating crop sowing norms, adjusted for absolute wt. of the seed: $N_1 = N\left(\frac{A-A_1}{A} + 1\right)$ where N_1 = sowing norm (in millions of germinating seed/ha.) ; N = sowing norm for a given region and variety (in millions of germinating

seed/ha.) ; A = 1000-grain wt. (as claimed by the breeder) ; A_1 = actual absolute wt. of the sown seed; 1 = a constant (to facilitate the calculation). —M.H.

1809 KEATING, F. E. and MATHEWS, O. R. **Soil and crop studies at the Big Spring (Texas) Field Station, 1916-53.** *Prod. Res. Rep. 1, U.S. Dep. Agric.*, 1957, pp. 31, bibl. 8, illus. [Texas Agric. Exp. Sta., College Station]

Rainfall in the Big Spring area was limited and poorly distributed. The most productive and reliable crops were cotton and sorghums. Yields of maize and winter wheat were unsatisfactory. Good yields were obtained from groundnuts, but the lack of a crop residue after harvesting allowed considerable wind erosion to take place during March and April. For all crops, autumn ploughing produced higher yields than spring ploughing. Lister planting without previous tillage produced the lowest yields. Subsoil tillage produced higher yields of all crops except milo [*Sorghum vulgare* var.], but only when cotton was grown was it profitable. The most suitable tillage practice for milo was late autumn listing, knife cultivation in the spring to control weeds until sowing time, and sowing with a lister by splitting the ridges. Sowing with furrow openers gave higher yields of cotton and kaffiir corn (*Sorghum vulgare* var.) than surface sowing. In the rotation experiments, ploughing-in *Vigna sinensis* as green manure did not produce increases in yield of following crops sufficient to offset the value of the hay lost. Where alternating paired rows of 2 different crops were grown in the same field, increased yields of one crop were accompanied by corresponding reduced yields of the other crop. —R.B.

SOIL AND WATER CONSERVATION

1810 DOUGHTY, J. L. **Twenty-five years progress in the theory and practice of moisture conservation.** *Emp. J. exp. Agric.* 1958, **26**, No. 102, 85–91, bibl. 5. [Soil Res. Lab., Swift Current, Sask.]

The conservation and use of moisture under the climatic conditions of the prairie area of W. Canada are considered. The value of fallowing for moisture conservation must be balanced against danger from erosion following excessive cultivation to remove weeds. Data are summarized, showing the % conservation of precipitation at different seasons during a 21-month fallow period. The use by crops of moisture stored in different types of soil is discussed. The following factors influencing conservation are mentioned : distribution of precipitation rather than amount ; time of cultivation for weed control ; use of shelter-belts.—A.M.H.

1811 LARSON, W. E. and SCHALLER, F. W. **Spacing of level terraces in western Iowa.** *Agric. Engng, St. Joseph, Mich.*, 1958, **39**, No. 1, 20–3. [Iowa Agric. Exp. Sta., Ames]

Level terraces with spacings of 1·25, 1·5, 1·75 and 2 times normal were compared at the W. Iowa Experimental Farm between 1949 and 1956. At the time when the experiment was started, the standard vertical interval between terraces was (S+3)/2 ft., where S was the percentage slope of the ground. The average land slope of the experimental plots varied from 12 to 14%. All terraces were constructed with a channel large enough to hold 2 in. of runoff. Maize, oats, and a 2-yr. ley of bromegrass and lucerne were grown in a 4-yr. rotation. The maize was always contour-listed. After 8 years, the terrace-channel capacities of the 1·5- and 2-times-normal terraces had decreased by 10%. Runoff and terrace overflowing during storms were negligible over the observed period, even though during one storm 2·84 in. of rain fell in 1 hr. Another series of experiments to measure runoff and soil loss was conducted. Runoff from contour-listed maize undersown with *Melilotus alba* never exceeded 0·88 in. in 24 hr. Runoff from contour surface-planted maize reached 1·58 in. Over a 9-yr. period, soil losses in tons/ac. averaged 2·8 for contour-listed maize, 8·9 for contour surface-sown maize, and 22·6 for maize sown up and down hill. It was concluded (a) that level terraces in W. Iowa could be spaced wider than currently recommended, (b) that rotations with a greater percentage of maize than the maize/oats/2-yr. ley rotation could be used on gradients up to at least 12%, provided that in both cases the maize was contour-listed. F.S.—R.B.

1812† QUACKENBUSH, T. H. and others. **Conservation irrigation in humid areas.** *Agric. Hbk. 107, Soil Conserv. Serv., U.S. Dep. Agric.* 1957, pp. 52, illus.

This handbook gives a comprehensive description of the various methods of irrigation suitable for use in the states east of Texas, Oklahoma, Kansas, Nebraska, and N. and S. Dakota.—R.B.

1813 WARING, S. A. and others. **Fertility investigations on the black earth wheatlands of the Darling Downs, Queensland. 1. Moisture accumulation under short fallow.** *Aust. J. agric. Res.*, 1958, **9**, No. 2, 205–16, bibl. 17, illus. [Dep. Agric., Univ. Qd, Brisbane]

The accumulation of soil moisture during the period of summer fallow between successive winter crops of wheat was examined for a number of localities on the Darling Downs, for the seasons 1951–4. The moisture gain to a depth of 4 ft. between the harvest of one crop and the sowing of the next ranged from —0·3 to 5·0 in., with an

average of 2·2 in., representing 17% of the rainfall. Available moisture at sowing averaged 4·8 in., the excess of 2·6 in. over fallow being due to the available moisture already in the soil at the preceding harvest. The average values for available moisture at sowing were well below the storage capacity of these soils down to 4 ft. Values following a long fallow (12–15 months) averaged 6·5 in., and were as high as 9·9 in. in one instance. Total rainfall during the fallowing period was not correlated with fallow moisture gain. Fallow moisture gain and available moisture at sowing were correlated with March-April rain. Fallow moisture gain was negatively correlated with available moisture at the preceding harvest and positively correlated with available moisture at sowing. The clay content of the soil and depth of surface mulch were not significantly related to fallow moisture gain, nor to available moisture at sowing. No significant difference in moisture accumulation was observed between sites stubble-mulched and those stubble-burnt. Explanations in terms of climatic and soil characteristics are offered for the results obtained. Features considered important are the characteristics of the rainfall and the high-evaporation conditions, the low rate of moisture penetration in wet soil, and the high moisture-holding capacity of the surface soil layers. F.S.—A.M.H.

1814† Sless, J. B. **Coastal sand drift. 2. Control measures.** *J. Soil Conserv. N.S.W.* 1958, **14,** No. 1, 50–68, bibl. 9, illus.

Mechanical and vegetational control measures are discussed. On the central and north coasts of N.S.W. mechanical methods must precede establishment of vegetation, but on the south coast, fewer mechanical measures are necessary. The previous classification of sand-stabilizing plants [see *Herb. Abstr.* 27 : 680] is revised and spp. are classified according to their ability to withstand sand-dune conditions. The only spp. classified as primary stabilizers are *Ammophila arenaria* and *Spinifex hirsutus.* The group of secondary stabilizers includes 6 spp. of grasses, 6 of creepers and 6 of shrubs. Tertiary stabilizers listed are the trees *Banksia integrifolia, Casuarina equisetifolia* and *Erythrina corallodendron.* A planting programme is outlined as a guide for sand-stabilization work and 12 spp. no longer regarded as useful are listed.—A.M.H.

1815† Pereira, H. C. **The limited utility of flood-water in the Perkerra River irrigation scheme, Kenya.** *E. Afr. agric. J.* 1958, **23,** No. 4, 246–53, bibl. 2 (in text). [E.A.A.F.R.O., Kenya]

The Perkerra River has a violently flash-flooding regime varying from 55,000 to 10 cu. ft./sec. Experiments on the use of a single heavy flooding for the growth of crops on stored soil-moisture are described. Increases in moisture content of the first 6 ft. of soil ranged from 6·6–13·4 in. after basin-flooding and from 7·4–11·4 in. after ridge-and-furrow irrigation. Maize roots failed to penetrate more than 2 ft. into the heavy wet soil and the crops died without using the water stored at 2–6 ft. It was concluded that heavy reliance must still be placed on the dry-weather river flow. The importance of improving land use throughout the catchment area is stressed.—A.M.H.

1816† Ranbir Singh. **A note on the value of shelter-belts and wind-breaks in soil conservation.** *J. Soil Wat. Conserv., India* 1957, **6,** No. 1, 49–51, bibl. 7.

The pros and cons of the wind-break along the W. and N.W. frontier of India, recommended in 1954, to consist of a belt of trees 400 miles long and 5 miles wide, are discussed. Trees 60 ft. high would give protection from the westerly winds for a distance of only 1200 ft.—D.B.

AGRICULTURAL METEOROLOGY AND CLIMATOLOGY

See also Abs. 1544

1817 Howe, G. M. **Climate in relation to crop production [in the British Isles].** *Agric. Progr.* 1957, **32,** 39–53, bibl. 24, illus., 8 maps. [Dep. Geog. Anthrop., Univ. Coll. Wales, Aberystwyth]

1818† Stamp, L. D. and Richards, P. W. **Climate, vegetation and land utilization in the humid tropics.** *Nature, Lond.* 1958, **181,** No. 4609, 596–8.

Papers read at the 9th Pacific Science Congress, held in Bangkok, Thailand, during Nov.-Dec., 1957, are reviewed.—M.H.

1819† Nyberg, A. **Meteorologiens betydelse för skogs- och jordbruksforskningen. The importance of meteorology to research in forestry and agriculture.** *K. Skogs LantbrAkad. Tidskr.* 1957, **96,** No. 5/6, 314–28, English summary.

Aspects discussed include : climatic factors and their measurement, the effect of climate on the physiology of plants and disease incidence, plant growth chambers, glasshouses, secular changes in climate, irrigation, wind shelter, erosion, frost, forest fires, and climate in relation to livestock.—P.J.B.

1820 Gusev, N. A. **Effect of dry winds on water relations in plants.** [Russian] *Fiziol. Rast. (Pl. Physiol., USSR)* 1957, **4,** No. 4, 305–11, bibl. 20, English summary. [Biol. Inst., Kazah Filial Acad. Sci. USSR]

1821† Glover, J. and McCulloch, J. S. G. **The empirical relation between solar radiation and hours of sunshine.** *Quart. J. roy. met. Soc.* 1958, **84,** No. 360, 172–5, bibl. 6.

1822† Kenworthy, Joan M. and Glover, J. **The reliability of the main rains in Kenya.** *E. Afr. agric. J.* 1958, **23,** No. 4, 267–72, bibl. 5, 3 maps. [E.A.A.F.R.O., Kenya]

The reliability of rainfall in different regions during the main crop-growing season has been estimated. In the area west of the Rift Valley, the period considered is April-August ; east of the Rift Valley, March-May ; and in the coastal strip, April-June. 3 maps show the areas in which the probability that the rainfall in the growing season will be less than 15, 20 and 25 inches is 0–10, 10–20, 20–30 and 30–100%. The maps emphasize the contrast between the area west of the Rift Valley and the rest of the country.—A.M.H.

1823† Fujiwara, T. and Ishiguro, T. [**On the long-term changes of air temperature which have been observed at the Agricultural Experiment Stations in Hokkaido.**] [Japanese] *Res. Bull. Hokkaido Nat. Agric. Exp. Sta.* 1957, No. 72, 127–30, bibl. 8, English summary.

Observations at the above experiment stations, record that air temperature in July and August during the past 50 years has been rising steadily by 0·04 to 0·05°C. per year. The temperature is now 2·0 to 2·5°C. higher than 50 years ago. The air temperature in spring has also increased. F. Eng. s.—D.B.

1824† Good, R. **The biogeography of Australia.** *Nature, Lond.* 1958, **181,** No. 4626, 1763–5, bibl. 2. [Univ. Hull]

MISCELLANEOUS

1825† Ministry of Agriculture, Fisheries and Food, England and Wales. **Crop Protection Products Approval Scheme. Approved list 1958.** *Publ. Minist. Agric., Fish, Fd, England and Wales* 1957, pp. 66.

1826† Ministry of Agriculture, Fisheries and Food, England and Wales, and Department of Agriculture for Scotland. **The safe use of poisonous chemicals on the farm.** *Leafl. APS/1 Minist. Agric., Fish., Fd, England and Wales* 1958, pp. 19.

1827 Martin, H. **Guide to the chemicals used in crop protection.** 3rd edn, 1957, pp. 306 + suppl. pp. 9, 28 × 21·5 cm., London, Ontario : Canada Department of Agriculture Science Service, $2·00.

This book contains useful data on most of the chemical compounds currently used in crop protection. For each compound are given : alternative names, history, method of manufacture, physical, chemical and biological properties, formulations, and methods of analysis. The guide is produced in a form suitable for insertion in a loose-leaf binder ; supplementary pages will be issued at intervals as new chemicals become available. The index has been prepared with wide spacing to allow of manuscript additions. This is a valuable reference work for all who employ chemical methods for crop protection.—R. Boyce.

1828 Lindström, O. **Seed disinfection. Mechanism of liquid seed treatment. Vapor action and adhesion, radioactive studies of initial liquid distribution, and investigations with radioactive Panogen formulations.** *J. agric. fd Chem.* 1958, **6,** No. 4, 283–98, bibl. 27, illus. [AB Casco, Stockholm 11, Sweden]

1829 Winner, C. Zur praktischen Bewertung der Anwendung von Saatschutzmitteln bei einer Pflanzenkultur mit gleichmässiger Standweite (Beta-Rüben). [**A practical evaluation of the application of seed protectants in a crop which has evenly spaced plants (sugar-beet).**] *Z. PflKrankh.* 1958, **65,** No. 3, 149–53, English summary. [Inst. f. Zuckerrübenforsch, Göttingen, W. Germany]

Two components of the effects of seed treatment (with disinfectants) are discussed : (a) that on emergence and hence density of stand, and known as the maintenance effect ; (b) that on the growth, weight, and hence yield of individual plants, and known as the growth-promotion effect. Results of experiments carried out over several years show that the latter is the more important.—D.B.

1830 Long, W. H. **Effects of chemical seed treatments on wireworm** [*Melanotus communis*] **activities.** *Iowa State Coll. J. Sci.* 1957, **32,** No. 2, 213–5. [Received May, 1958]

See also Abs. 1451.

1831 Jones, F. G. W. **Aspects of plant nematology in Great Britain.** *Agric. Rev., Lond.* 1958, **3,** No. 12, 8–19, illus.

The susceptibility of a number of host crops to various cyst-forming eelworms is tabulated, together with the efficiency of these crops in raising the soil population of the eelworms concerned and the critical population levels above which it is unsafe to plant. Control is still based largely on crop rotation combined with soil-population estimates. Trap-cropping has not proved worthwhile.—A.M.H.

1832† Thomas, I. and Janson, H. W. **Common names of British insect and other pests.** *Tech. Bull. 6 Minist. Agric. Fish., Fd, England and*

Wales 1957, pp. iii + 49, London : H.M.S.O., 7s. 6d. [Received April, 1958]

1833 Jamalainen, E. A. Peltokasvien huonon talvehtimisen syistä ja talvituhosienien aiheuttamien vahinkojen torjuntatoimenpiteistä. **On reasons for poor overwintering of field crops and the control measures against damage caused by low-temperature parasitic fungi.** *Maatal. ja Koetoim.* 1958, No. 12, 55–63, English summary. [Agric. Res. Centre, Tikkurila, Finland]

Low-temperature parasitic fungi are the most frequent cause of poor overwintering in field crops. The use of 20% PCNB applied once or twice in autumn as a dust, 20–50 kg./ha., is considered a promising remedial measure. F.Eng.s.—M.H.

1834 Riepma Wzn, P. De invloed van organische bemesting en bekalking op opbrengst en kwaliteit van aardappelen, granen en peulvruchten. [**Effect of organic manures and liming on yield and quality of potatoes, cereals and pulse.**] *Rep. Exp. Fm "De Bouwing", Randwijk* [n.d.], 33–7. [Received 1958]

In the 1952–5 trials at De Bouwing Experiment Farm (river-clay soil) it was found that liming alone improved the yield of the potato variety Bintje, but made little impression on that of Eigenheimer. The yield of summer barley was favourably affected by liming. Organic manures generally produced no reaction in potatoes, although when applied in combination with liming a slight depression of yield usually occurred. In summer barley the use of organic manures generally resulted in better yields, probably attributable to the nitrogen liberated from the manure and also to the improved drainage of the farm during the period of the trials. No definite conclusions were reached concerning the effect of organic manures and liming upon the quality of the crops, but the impression was received that there was no improvement in quality, but sometimes a certain deterioration, e.g. in malting barley.—G.M.R.

1835 Holme, R. V. and Sherwood, E. G. P. **The fertilizer requirements of the Kenya Highlands.** *Final Rep. Highland Fert. Scheme, 1948–50, Nairobi*, 1951, pp. 72, bibl. 5. [Received July, 1958]

This report is based on the results of 172 factorial field experiments in which the effects of various P fertilizers, ammonium sulphate, muriate of potash and ground limestone on wheat, maize, sunflower, potatoes, lucerne and grasses were studied. Residual effects were also measured.—A.M.H.

1836 Bellis, E. **Notes on Kenya agriculture. 2. Tabulated recommendations for manuring and fertilizing in African areas.** *E. Afr. agric. J.* 1958, **23**, No. 4, 234–5. [Dep. Agric., Kenya]

Recommended manurial treatments for arable crops on different soils in 5 provinces of Kenya are tabulated.—A.M.H.

1837† Engibous, J. C. **The effect of synthetic polyelectrolytes on some physical and biochemical properties of certain Ohio soils and upon yield and composition of plants.** *Diss. Abstr.* 1957, **17**, No. 12, 2733–6, bibl. 13, illus. [Ohio State Univ., Columbus]

In glasshouse and field trials, in which a range of soil conditioners of the krilium type were applied to 4 Ohio soils, there were no significant differences between the yield of soyabeans, maize, potatoes and sweet-corn, grown on treated and untreated soils.—P.J.B.

1838† Holliday, R. and others. **Plant growth on "fly ash".** *Nature, Lond.* 1958, **181**, No. 4615, 1079–80, bibl. 7. [Dep. Agric., Univ. Leeds]

Work on the reclamation of land covered with pulverized fuel waste (fly ash) has shown that, contrary to the results obtained by Rees and Sidrak [*Fld Crop Abstr.* 10: 768] who found that Al and Mn produce toxic effects in plants grown on fly ash, B is the dominant toxic element. Crops are classified into the following 3 groups on the basis of their tolerance to fly ash : tolerant (fodder-beet, mangels, *Brassica campestris* and *Melilotus alba*); moderately tolerant (clovers, lucerne, *Brassica oleracea* and other cultivated members of the Cruciferae, and *Lolium* sp.) ; sensitive (cereal grasses [especially barley], peas, vetches, beans, potatoes, *Fagopyrum esculentum* and *Dactylis glomerata*). This grouping corresponds closely to that for plant reaction to B [*Herb. Abstr.* 15 : 675]. The degree to which toxicity is manifest in plants grown on fly ash (containing 18–51 ppm. water-soluble B in the tests with unweathered ash) depends partly on the source of the ash and the amount of weathering or leaching to which it has been subjected.—M.H.

1839† Lindenbein, W. Zur Entwicklungsgeschichte der Keimprüfung. [**A history of the development of seed testing.**] *Landw. Forsch.* 1958, Sonderheft 11, 68–74, bibl. 18. [Landesanstalt für Samenprüfung, Stuttgart-Hohenheim, W. Germany]

1840† Kungl. Lantbrukshögskolan och Statens Lantbruksförsök. Sweden. Jordbruksförsök under 50år. Historik, referat av Meddelanden åren 1907–1938, förtecningar över utgivna skrifter och författareregister åren 1907–1957. **Swedish official experiments in agronomy during 50 years. Historical data, reviews of papers in 1907-1938, lists of publications, list of authors in 1907-1957.** *Medd. 81 Stat. JordbrFörsök* 1957, pp. 207.

1841† Hendrie, D. S. **The production of home-grown foods and grass.** *12th Oxford Fmg Conf.* Jan. 1958, pp. 19–31. [West of Scotland Agric. Coll., Glasgow]

The possible yields, in terms of starch equivalent, digestible crude protein and dry matter, obtainable from swede-turnips, oats, barley, kale, beans, grass, hay and silage are discussed. The value of fertilizer treatments and, in the case of the arable crops, of the use of weed-killers is considered for each crop. The costs of production (£/ton S.E., man-hours/ton S.E. and man-hours/ac./yr.) for each are compared.—A.M.H.

1842† Ministry of Agriculture. Northern Ireland. **Sixth Report upon the Agricultural Statistics of Northern Ireland 1930-1953.** Belfast, 1957, pp. 159. [Received April, 1958]

REPORTS

The notes below indicate the main investigations in the reports covered, in so far as they concern this journal. Where a separate abstract has been made from a particularly interesting section of a report, this is indicated.

1843 **Great Britain.** Report of the Rothamsted Experimental Station for 1957. Harpenden, 1958, pp. 316, 1 map, 10s. 6d. [Received July, 1958]

1. Woburn irrigation experiments, pp. 43–4. Full irrigation (plot-soil maintained near field capacity) from April to September increased yields of beans [*Vicia faba*] by 15 cwt./ac. and of spring wheat by 3–7 cwt./ac. (part of the apparent increase was due to fungus attack in control plots). Sugar-beet yields were slightly decreased in the irrigated plots.

2. Chelated Fe complexes as sources of Fe in solution culture, pp. 83–4. Complexes of Fe with the following compounds were tested : (a) monosodium ethylenediamine tetra-acetate, EDTA(Na); (b) hydroxyethyl ethylenediamine triacetic acid, HEEDTA ; (c) diethylenetriamine penta-acetic acid,DTPA; (d) ethylenediamine NN′bis (hydroxyphenyl acetic acid), CHEL 138. 0·125 ppm. Fe supplied as (d) or 0·25 ppm. as (a), (b) or (c) prevented Fe-deficiency symptoms in pea shoots. For soyabeans, 0·5 ppm. Fe as (d) was necessary compared with 1 ppm. in the other forms. The complex with (d) was equally efficient at pH 5·5 or 7·5, but the other complexes were less efficient in alkaline solution.

3. Photosynthesis of leaves at different levels in a crop, pp. 91–2. Removal of the 4 lowest leaves from kale plants having an average of 11 leaves per plant, decreased leaf area by 40%, but dry-matter production per unit area of crop by 13% only. The 7 lowest leaves, 71% of the leaf area, accounted for 34% of the dry-matter production. Net assimilation rates (g./sq. m. of leaf area/week) were : 4 lowest leaves, 23 ; 3 middle leaves, 48 ; upper leaves (usually 4), 112.

4. Large-scale production of leaf protein, pp. 101–2. Yields of extracted protein obtained were : tares (*Vicia* sp.), 1st cut, 120 lb./ac. (2 extractions), 2nd cut, 33 lb./ac. (2 extractions) ; maize, 1st cut, 67 lb./ac. (2 extractions) and 111 lb./ac. (1 extraction) ; sugar-beet leaves, 730 lb./ac. (high watering), 477 lb./ac. (low watering). The protein was used for feeding pigs and poultry. Culinary uses are also described.

5. Sprouting of stored mangels, pp. 113–14. Orange Globe mangels, irradiated in November, 1956 with γ-rays at 0, 5000, 10,000, 20,000, 30,000 and 40,000 rads, showed mean sprout-lengths in April of 5·7, 3·2, 1·5, 0·0, 0·0 and 0·0 in., respectively. Tetrachloronitrobenzene was more effective as a sprout depressant on topped than on untopped mangels.

6. Control of *Aphis fabae* on spring-sown field beans, pp. 146–7. Demeton-methyl (6 oz./ac.), and compound 4741 and fluoroacetamide (each at 3 oz./ac.), at medium (60 gal./ac.) or low (10 gal./ac.) volume, increased seed yields from *c.* 4 to *c.* 27 cwt./ac.

7. Deep cultivation experiment, 1944–56, pp. 193–9. [See also *Fld Crop Abstr.* 10 : 707.] A preliminary account of the concluding phase of this experiment is given. Deep ploughing (12 in.) increased yield of sugar-beet by *c.* 6%, but not that of potatoes or wheat. The effect was very variable from season to season. The residual effect of deep ploughing measured in cereals and hay after 1, 2 or 3 seasons was negligible. Raw subsoil could generally be reduced to a seedbed for sugar-beet and no loss of plant number or yield occurred. These seedbeds were often cleaner than those on shallow-ploughed land. Dung ploughed-in deeply for sugar-beet had slightly less effect than if ploughed-in shallowly. PK for sugar-beet was more useful when ploughed-in than when applied to the seedbed, deep ploughing being most effective. PK for potatoes was more efficient when placed in the ridges, instead of being ploughed-in. [See also Abs. 1544, 1616, 1660, and 1756.]—A.M.H.

1844 **Great Britain.** Report of the West of Scotland Agricultural College for the year ended 30th September, 1957. Glasgow, 1957, pp. 81. [Received April, 1958]

1. Oats, pp. 31–2. Abed Max, Sisu and Weibull's 16004 gave significantly higher yields than Sun II at Auchincruive. Pendek yielded 20% less than Sun II at both Auchincruive and Sorn.

2. Barley, p. 32. Drost gave a significantly higher yield than Ymer, but ripened a week later.

3. Winter wheat, p. 32. Banco and Hybrid 46 each yielded 2 tons/ac. Cappelle Desprez (with 40% lodging) gave only 33 cwt./ac.
4. Potato root eelworm [*Heterodera rostochiensis*], p. 48. An improved field-scale machine for mixing non-volatile materials with soil has been used in treatment of eelworm-infested soil. 9–11 cwt./ac. of dust containing yellow oxide of Hg (5·5 lb. Hg equivalent/ac.) were used. Infested soil was treated 6 days before planting and yields of main crop Kerr's Pink increased by 24% and 34% over the controls (6·5 and 7 tons/ac.). With intervals of less than 6 days between treatment and planting, yields remained the same or decreased. Indications are that this treatment is cheaper than the use of DD.—A.M.H.

1845 **Great Britain.** National Vegetable Research Station. Eighth Annual Report, 1957. Wellesbourne, Warwick, 1958, pp. viii + 67, 3 maps. [Received June 1958]

Loss of water from plant/soil systems, pp. 39–41. The relative water loss (relative to loss from an open water-surface adjacent to the crop) from a carrot crop increased with increasing plant cover until 40% of the soil surface was covered by foliage. It then remained constant and was unaffected by further growth. The relative water loss from carrots was compared with that from a short grass crop completely covering the ground. Values obtained for the 2 crops were 1·75 and 1·0, respectively, when the soil was watered daily, and 0·84 and 0·67, when the soil received rainfall only.

Control of weeds in field beans by the use of dinoseb (amine) as a post-emergence spray, p. 53. Under dry conditions in 1957, 2 lb./ac. was significantly better than 1 lb./ac. and highest yields were obtained from spraying when the beans had one expanded leaf.—A.M.H.

1846† **Great Britain.** Committee of the Privy Council for Agricultural Research. Agricultural Research Council. Report for the year 1956–7, London, 1958, pp. iv + 152, 7s.

1847 **Netherlands.** "De Bouwing" Experiment Farm, Randwijk. Vijf jaar De Bouwing. Verslag van de Proefboerderij "De Bouwing" bij Randwijk over de jaren 1951 t/m 1955. [Five-year report 1951–5.] Wageningen, [n.d.], pp. 89, illus., mimeo.

"De Bouwing" is a 34-ha. farm situated on river-clay soil near Randwijk in the region known as the Betuwe. It was acquired in 1950 as an experiment farm by the former Central Institute for Agricultural Research, Wageningen, and now continues to function under the three Institutes into which the Central Institute has been divided. Annual reports have been published [see *Fld Crop Abstr.* 11 : 430], but the present report summarizes the somewhat exploratory work of the years up to 1955, when the formal opening of the Farm took place.
1. Soil studies ; by S. Sevenster, pp. 4–5. The river-clay soil is poor in calcium and has moderate to poor structure. Drainage was at the outset poor, weed infestation severe. The principal aim of the farm is research in crop production.
2. Tillage ; by D. van Hemmen, pp. 21–2.
3. Manuring, general; by M. Draisma, pp. 23–30, bibl. 5.
4. Long-term trials of nitrogenous fertilizer ; by F. van der Paauw, pp. 31–3.
5. Effect of organic manures and liming on yield and quality of potatoes, cereals and pulse ; by P. Riepma Wzn, pp. 33–7. [See Abs. 1834.]
6. Long-term soil fertility studies ; by G. J. Wisselink, pp. 38–41.
7. Weed control, general ; by D. van Hemmen, pp. 42–3.
8. The selectivity of herbicides ; by R. Sijtsma, pp. 43–55. [See Abs. 1773.]
9. Crop yields ; by K. Heringa, pp. 56–60. Yields obtained on the Experiment Farm are compared with the regional average and with those of other regions.
10. Preliminary cereal spacing trial ; by W. H. van Dobben, pp. 62–7. [See Abs. 1523.]
11. Studies of pulse-growing (manuring, choice of canning pea varieties, spacing and harvesting) ; by P. Riepma Wzn, pp. 68–70. [See Abs. 1573.]
12. Maize-growing ; by W. R. Becker and G. H. de Haan, pp. 70–3. [See Abs. 1439.]
13. Killing of potato tops by spraying ; by A. Schepers, pp. 74–7.—G.M.R.

1848 **Nigeria.** Annual Report of the Agricultural Research for the year 1956–57. Lagos, 1958, pp. 48. [Received July, 1958]

Cassava, p. 15. At Moor Plantation, var. 53101 gave the highest yields (14 tons/ac.). Plants grown from cuttings taken from the base of the main stem yielded significantly more than those from cuttings from the top of the main stem or from lateral branches. In a 2-yr. trial with var. 37065, the mean number of tubers did not increase with age ; the growth rate of tubers was at a maximum at 9–12 months, with a further period of rapid growth at 20–21 months. After 2 years' growth, 20% of the tubers of 53101 had rotted in the ground, but growth of 55123 was continuous over the 2 yr.

Control of yam beetles (*Heteroligus meles*) by insecticidal dusts applied to seed yams at planting, pp. 35–6. 0·45% γBHC dust increased average yields by 32% and decreased the average % tubers attacked by 22%. Corresponding figures for a 2·6% γ BHC dust based on crude BHC were 14–20% and 13–31% ; for 50% chlordane wett-

able powder, 33% and 32%; 2·6% γ BHC (lindane) reduced % tuber damage by 22%. None of these insecticides affected the flavour of the yams. —A.M.H.

1849 **Kenya.** Department of Agriculture Annual Report 1956. Vol. 2. Record of Investigations. Nairobi, 1958, pp. 181. [Received June, 1958]

1. Report of the Senior Plant Breeder, pp. 29–35. Wheat trials. At Njoro, the accessions La Prévision, Rio Negro and H.305 were the best varieties, but are susceptible to stem rust [*Puccinia graminis tritici*]. At Eldoret, highest yields were from 358.AA.5.B., La Prévision, 367. AR.3.B.1.A. and H462.A.3.4.2.3. Barley trials. At Njoro, top yielders were No. 5 from Eire, followed by Rigel, Proctor, Kenia, Binder and Heimdal; at Eldoret, No. 5, Bonus, Kenia, Proctor and Research. Oat trials. Best-yielding varieties at Eldoret were Southland, C.I.5430, R.L.1734, R.L.1674 and Zephyr.

2. Report of the Agricultural Officer (Experiments), Nyanza Province, pp. 142–52. Drainage and P trials on vlei soils. Plots protected on the upper side by a bank and a cut-off drain generally gave higher yields of maize, potatoes and wheat than plots receiving a free flow of water from higher land. Ridge-and-furrow cultivation gave better maize and potato yields than growing on flat ground. Fertilizer rates trial. The residual response of maize to 0·96 cwt./ac. superphosphate applied in 1955 gave an economic gain over the control, but was not quite significant. There was no response to residual N. Sorghum variety trials. Dobbs ex Bukura and Enyanza ex Tanganyika significantly outyielded all varieties tested, except B.C.81 and the red local sorghum.

3. Report of the Agricultural Officer (Experiments), Coast Province, pp. 171–81. Cassava. In a variety trial at Matuga, 46106/26 and 4697/4 were the top yielders. 5-ft. ridges gave significantly better yields than flat cultivation, but 6-ft. ridges with wider plant spacing did not. A July-planted crop gave as good a yield in 12 months on 25 in. of rain as an April-planted one did in 16 months on 53 in. of rain. Cotton. UK51 and UK48 outyielded N17 and 47/10. Early sowing (mid-April) gave the highest yields. Mulching with dried grass depressed yields. Groundnuts. 1·5 cwt. double superphosphate [per ac.] trebled yields under both ridge- and flat-cultivation. In the presence of P, Natal Common was the best-yielding variety. Short-term resting crops. Short-rains crops of beans or teff grass [*Eragrostis abyssinica*], dug in, led to higher yields of sorghum grown in the long rains than did velvet beans [*Stizolobium* sp.] cut and used as a mulch. Residual effects of P and f.y.m. applied in 1953 were also apparent.—A.M.H.

1850 **Tanganyika.** Department of Agriculture. Annual Report for 1956. Part 2. Dar-es-Salaam, 1958, pp. 106.

1. Ukiriguru, pp. 4–26. Good cultivation considerably reduced the incidence of smut while the Dobbs variety outyielded other sorghums. The 42B line yielded more than SUKI and was superior to it in weevil resistance but below that of Wiru. Selection continues for yield, quality and weevil resistance as well as for resistance to bird damage in pendant heads with large glumes and increased awn length. The development of tetraploid sorghums continues. Dobbs variety suffered less from *Striga* than Bakura Mahemba. Rice selections continued with Kahogo as the reference standard. [For cotton, see Abs. 1685.]

2. Ilonga, pp. 40–58. Significantly higher yields resulted from early sowings of Natal Common groundnuts. The good season possibly influenced maize trials where neither fertilizers, spacing nor ridging gave outstanding responses. With soya-beans, yields decreased with later sowings.

3. Bagomoyo, pp. 59–61. Eight introduced, and the local Kibangiri, cassava varieties were reasonably resistant to mosaic. Afaa and Kahogo rice selections were again the best.

4. Southern Highlands Province, pp. 67–75. Manure, but not phosphate, gave significant increases in wheat yields while manures were highly significant in augmenting maize yields.

5. Nachingwea, pp. 76–80. Studies continued of dusting for the control of *Aphthona bimaculata* beetles on sesame and *Antherigona indica* on sorghum.

6. Mahiwa, pp. 81–2. Whereas P and NK treatments gave significant yield increases from Msumbij sorghum, placement of minerals was no better than broadcasting. Farmyard manure also increased yields significantly as did its placement.

7. Tanga Province, pp. 96–106. Varieties of potato which have remained free from *Phytophthora infestans* for ten or more years are being grown while Bwaza sweet-potatoes have, over 5 years, proved to be the best of 15 varieties. With many crops, ridging was superior to flat cultivation and tie-tidging better than plain ridging.—M.H.F.

1851 **Tanganyika.** Veterinary Department. Annual Report for 1956. Vol. 2. Dar-es-Salaam, 1958, pp. 105.

1. Interplanting maize and sorghum with velvet bean [*Stizolobium* sp.], p. 20. This was found to facilitate harvesting of the beans. Two rows of sorghum to one of beans proved the best ratio.

2. Residual fertilizer trial, pp. 20–1. Treatments applied at the end of 1954 were as follows: (a) farmyard manure, 5 tons/ac.; (b) NPK (superphosphate, 123 lb./ac., potassium chloride, 75 lb./ac., ammonium sulphate 75 lb./ac.), (c) farmyard manure + NPK; (d) no fertilizer. Increases in maize yields per ac. resulting from residual effects of (a), (b) and (c) were 215 lb., 125 lb. and 186 lb., respectively, and correspond-

ing increases in bean [*Stizolobium*] yields were 468 lb., 230 lb. and 537 lb./ac.
3. Maize trials, p. 23. On red soil, Katumbili gave the highest yield of 3 varieties and on grey soil, yellow maize gave the highest yield.—A.M.H.

1852 **Belgian Congo.** Institut National pour l'Étude Agronomique du Congo Belge. Rapport annuel pour l'exercice 1956. [Annual report for 1956.] Bruxelles, 1958, pp. 548, bibl. 84.
1. Rice. From Yangambi trials, the lines R 20, R 66, R 67 and R 75 were selected for distribution on account of their yields and grain qualities, pp. 103–6. At Mvuazi R 67, R 55, R 7 and R 76 gave the best yields (2890–2770 kg./ha.) in preliminary trials, and the advantage of sowing in October was demonstrated, pp. 245–6. The importance of fertilizers containing soluble phosphates was shown at Bambesa, p. 328. At Boketa, yields of dried grain ranged from 2635 to 2740 kg./ha. for the varieties R 23, R 75, R 10, R 49 and R 20, p. 348. In Kiyata trials, R 67, R 66, Ca 902/b/2/1, Ca 902/b/2/2, R 53 and R 76 yielded more than 4000 kg./ha. of paddy, p. 386. At Luberizi only RE 101 exceeded 4000 kg. of paddy/ha., but RE 127, L3, L7 and L9 did so at Mutimbizi, p. 400. The best yield at Kibangula was 1834 kg./ha. from R 20, p. 411, but at Mount Hawa, R 10 and R 67 both produced 1850 kg./ha., p. 496.
2. Maize. In forest valley soils at Gimbi, the varieties HD 1158, HD 1157 and Gan F_1 yielded 6489, 5725 and 5137 kg. of dried cobs/ha., respectively, p. 265. Phosphates affected yields of grain at Bambesa only, p. 328. The varieties Finkoni, Bilibili and Dologbea yielded better (1873–2643 kg. of grain/ha.) at Boketa than the local white maize which yielded 1524 and 1832 kg./ha., p. 348. First- and second-season grain yields at Gandajika are summarized and, whereas the control Gan F_1 yielded 1383 and 3021 kg./ha., respectively, the varieties HD 1158F_1, GPS_2G_3, GPS_2G_6 and GPS_2G_7 yielded 118·4–105·4% of the control harvests, p. 369–70. The best yielder, Kahila, produced 1569 kg. of grain/ha. in the valleys and 1231 kg./ha. in the plateau of Kiyaka, p. 384–5. At Kibangula, the varieties GPS_2G_3 and $GanG_2$ gave dry grain yields of 3106 and 2913 kg./ha., respectively, compared with 1811 kg./ha. from the local maize, p. 410. Various combinations of NPK increased green-matter yields up to double that of the unfertilized maize (21,090 kg./ha.) while, in varietal trials, only Plata jaune yielded more green matter for ensilage than the control maize Gan, pp. 416–19. At Kaniama HD 1157 and HD 1158 were the heaviest producers of dried grain and yielded 6120 and 6080 kg./ha., respectively, p. 433.
3. Millet (*Pennisetum typhoideum*). Four varieties yielded 410–749 kg. of grain per ha. on the Kiyaka plateau while selections of Masangu variety yielded 1029 kg./ha., p. 385.
4. *Eleusine* [*coracana*]. The Kisozi variety produced 2371 kg. of grain/ha. at Kiyaka, p. 386. Lines 0228 and 0114, resistant to lodging, produced 113 and 97%, respectively, of the control yield of 2683 kg./ha. at Nioka, while the much taller 0308 and 0309 lines gave 120 and 98% of the control yield of 2312 kg./ha., p. 478. Esuruwa and local varieties gave the comparable yields of 1200 and 1176 kg./ha. at Mount Hawa, p. 497, while at Kisozi lines 09, B. K. and I. M. produced 1368–1266 kg. of dried grain per ha., p. 524.
5. Sorghum. The variety 021, yielding 1036 kg. of dried grain/ha., was significantly better than others at Nioka, p. 478. At Rubona, the varieties ST 38, Karuguma 020 and ST 71 were best with 6056–5452 kg/ha., pp. 502–3.
6. Wheat. No variety exceeded the dried grain yields of 130-1-77 grown at Kisozi and Nyakararo, viz. 1770 and 2406 kg./ha., respectively. The yield of wheat after potatoes was only 55% of the yield of 581 kg./ha. following beans, pp. 522–3.
7. Barley. In 2 trials in North Kivu, yields of malting barley were markedly different, and, although the Abed-Kenia variety yielded best in both cases, there was little difference between yields from the varieties Aurore, Balder, Research and Piroline, p. 469. The variety Research produced 2293 kg. of dried grain/ha. at Ruhunde in multiplication plots in one season but the yield averages over several years from both Kisozi and Ruhunde showed little differences between Aurore, Carlsberg, Abed-Kenia and Research.
8. Cotton. Insecticidal trials are reported from Yangambi against *Lygus vosseleri*, *Paurocephala gossypii*, *Hemitarsonemus latus* and *Helopeltis schoutedeni*, pp. 129–31. Studies at Bambesa confirmed the superiority of Bambesa 197 over Stoneville 5, pp. 316–19. The effectiveness of mulching, of fertilizer applications and of treatments against insect pests are being examined at Bambesa, pp. 325–35, and at Boketa, pp. 350–1. The variety C 2 maintained its superiority over Gar in both yield and resistance to insect attacks, whilst C2-1366 proved the best in trials at the Gandajika centre and in 36 out-stations, pp. 363–6. Fertilizer and insecticidal measures are also reported from Gandajika, pp. 375–9. The varieties 937, 1021 and 969 produced higher yields of seed-cotton and lint than the control 14-125 at Lubarika, pp. 397–9, while the C 2 varieties yielded better than Gar 162 at Kibangula, p. 409.
9. Groundnuts. Yields of over 2600 kg. of dried nuts/ha. were reported from Gimbi for the local variety, also A 3617 and A 65, p. 265. Yields of 3240–2970 kg. of shelled nuts/ha. were reported from Kondo for the varieties A 9, Bombi, A 65 and AE 36, p. 274. At Gandajika, Java types produced

slightly better than A 65 while the 0·2 × 0·2 m. spacing continued to yield best, p. 371. The liming of plateau soils at Kiyaka was necessary for producing yields equivalent to those reaped in the valleys, pp. 389–90. The variety A 1055 maintained its superiority at Lubarika and with A 65 either the sowing of 2 seeds at 0·1 m.- or 1 seed at 0·05 m.-intervals gave the best yields, 1083 and 1164 kg./ha., respectively, pp. 400–1. Although A 65 produced 1108 kg. of shelled nuts/ha. at Kibangula, 12 varieties proved superior to it and the 3 best varieties, A 1052, A 1059 and A 1037 yielded nearly twice its output, p. 410. From comparative trials at Mount Hawa the varieties E 50, A 3055, A 3393 and A 3511 yielded 976–1236 kg./ha., p. 495, while at Mosso the varieties A 3582, P 50, A 3393, A 65, A 92 and A 20 produced 1344–1253 kg./ha. of shelled nuts, p. 529.

10. Soyabeans. Sixteen varieties were sorted into maturity groups at Yangambi but seasonal differences complicated relative yield assessments, pp. 107–9. At Kiyaka, 3 varieties of K 92, as well as Otootan 70 and 8 Java 3334, yielded more than 1000 kg./ha. in each of 2 consecutive seasons, p. 387. SH 034, Yellow 1151 and SH 031 yielded more than 10,000 kg./ha. of green forage at Keyberg, p. 419. First-season yields of 1188–1556 kg./ha. are reported from Rubona with second-season productions of 721–1118 kg./ha., p. 504, while the best variety, Palmetto, under peasant conditions yielded 1498 kg. of dried beans per ha. in the first season, p. 509.

11. *Urena lobata.* At Gimbi, lime and NPK fertilizers not only increased fibre- and seed-yields but also exhibited carry-over effects on subsequent crops. Fibre yields of 282–1735 kg./ha. were recorded alongside seed production ranging from 433 to 1265 kg./ha., pp. 261–3. Under irrigation at Mosso, the application of fertilizers increased fibre yields from 861 to 1400 kg./ha., p. 528.

12. Yams. Six varieties at Mvuazi yielded more than 31,500 kg. of fresh tubers per ha., p. 244. At Kiyaka the varieties CSK No. 21 and SC 014 produced more than 20,000 kg. of tubers per ha., p. 388.

13. Cassava. At Yangambi the varieties 0129/45/11, 0442/45/15, 02945 and 02864 were best of 15 selections for dry-matter- and starch-production, p. 110. At Gimbi, 2961, 2726 and 2864 yielded 75,200, 69,600 and 64,800 kg. of fresh roots per ha., respectively, p. 264. In spite of a high incidence of mosaic, the varieties Ikiela, Notili, 097 and Tapicura yielded 38,011–25,966 kg./ha. at Gandajika, p. 373. Much lower yields are reported from Lubarika where Amer de six mois produced 13,013 kg./ha. which was at least double other outputs, p. 401. The varieties Criolinha 750 and Singa 443 yielded 55 and 50 metric tons/ha. at Mount Hawa, p. 497.

14. Sweet-potato. At Kiyaka Kimbonza ya Pembe yielded 13·1 tons of tubers/ha. in valley- but 3·2 tons/ha. only on plateau-soils, p. 388. At Mulungu-Tshibinda, local varieties were outyielded by M 46, Mugenda, Caroline Lee and 5037. The varieties Caroline Lee and Mugenda are recommended for altitudes above and below 1500 m., respectively, p. 459. The variety Maniexitu produced 27,038 kg./ha. in 9 months at Ituri, p. 478, while at Mount Hawa the varieties Singa Kilo and Dirikpa yielded 17 and 12 tons of tubers per ha., respectively, p. 497. In 2 seasons at Rubona, Caroline Lee outyielded other varieties with 27,580 and 26,100 kg./ha., p. 504. In Kisozi trials, the variety Mugenda yielded better than Norton Sam, p. 525.

15. Potato. Late, or medium-maturing varieties are best suited to wet season conditions at Keyberg and 6 of the 12 varieties tested exceeded 29,000 kg./ha. Under dry-season conditions, sprinkler irrigation gave a wide range of yields but 6 varieties again yielded more than 30,000 kg. of tubers per ha. Surface irrigation gave less than half the yields achieved with sprinklers. A combination of fertilizers and farmyard manure gave the best yield, pp. 420–1. The superiority of Eigenheimer potatoes was demonstrated in Kaniama trials, p. 431–2. At Rubona, the varieties Eigenheimer Holland and Sientje produced 9 tons/ha. in the first season and 10 tons/ha. in the second, p. 504. At Kisozi, the variety Star yielded a total of 30 tons/ha. over 3 plantings while Eigenheimer gave 25 tons/ha., p. 525.—M.H.F.

1853 **Western Australia.** Kimberley Research Station. Progress Report. *J. Dep. Agric. W. Aust.* 1958, **7**, No. 2, 238–57, illus.

This report reviews progress since 1950.

1. Rice, pp. 244–50. Caloro and similar *japonica* types are unsuitable for the wet, hot summer, but can be grown during May-October. Promising introduced tropical varieties include Emata-Yin and Hnan-wa-phin-gauh from Burma, Mas from Ceylon, Mbuyu, Moshi, Kohogo and Meli from Central Africa, Radin Siak from Malaya and Taichu 65 from Taiwan. The procedure adopted for bulk-cropping is described.

2. Sorghum, p. 250. Caprock yielded slightly more than Hegari, Kalo, Wheatland, Alpha and Martin. Marked response to P was recorded. In one trial 1 cwt. superphosphate/ac. increased yield from 620 lb. to 1940 lb./ac. Row-spacings of 1 ft. gave higher yields than 2 or 4 ft., but the differences may have been due to differential watering. Sorghum is now being grown for forage and not for grain because of bird damage.

3. Cotton, p. 251. Miller, Acala and Oklahoma Triumph gave average yields of 2200 lb. seed cotton/ac., when endrin was used to control bollworms. Such yields indicate economic possibilities for cotton-growing in the area.

4. Other fibres, pp. 251–2. Jute and kenaf produced were inferior in quality to imported jute.
5. Oilseeds, pp. 252–3. Early sowings of safflower, which flowers in late August or early September, can give high yields.
6. Assessment of agricultural potential of the Ord River plains, pp. 255–7. Irrigation is essential for successful crop production ; the water supply and topography of the area are favourable for this. The black soils of the region are deficient in P and N and, in the absence of a suitable legume, development must depend on comparative returns from fertilizer application. Crop production shows more promise than pasture production.—A.M.H.

1854 **Tasmania.** Department of Agriculture. Annual Report for 1955–56. Hobart, 1956, pp. 70. [Received June, 1958]
1. Barley variety trials, p. 26. The Danish variety Carlsberg outyielded English malting varieties. Grain quality was comparable with that of English varieties.
2. Potato variety trials, p. 31. Bismarck gave the highest yield of 6 early varieties. Of mid-season and late varieties, Sequoia gave the highest yields (12·5 tons/ac.).
3. Potato fertilizer requirements, Elliott Res. Fm, p. 31. A 1·5: 5: 1·5 mixture of $(NH_4)_2SO_4$, superphosphate and KCl at about 8 cwt./ac. gave on average the most economic results.
4. Potato-blight spraying trials, p. 38. Zineb at 1·5–2·5 lb./ac. at low-volume (40 gal.) and Bordeaux mixture 4–2–40 at high volume (120 gal.) were outstanding among Cu and organic fungicides tested. The mean yield of sprayed treatments was 6·1 tons/ac. as against 2·7 tons/ac. from unsprayed plots.
5. Weed control, pp. 32–3. At Smithton, common rush (*Juncus polyanthemus*) was controlled by 4 lb./ac. MCPA, or 2 lb./ac. 2,4-D amine or ester. At King Island, rushes were not killed by up to 4 lb./ac. 2,4-D ester. Dalapon at 4 oz./gal., or 40 lb./ac., controlled tall fescue [*Festuca arundinacea*], *Poa aquatica* and common reed [*Phragmites communis*]. PCP at 3 lb./ac. and power kerosene at 40–80 gal./ac. were effective pre-emergence herbicides, but neither was very effective on grasses. In 3 trials, soil was kept free of all plant growth [time limit not given] by CMU at 50 lb./ac. and borascu concentrate at 2400 lb./ac. (1200 lb./ac. in autumn and early spring). Sodium chlorate at 20 lb./ac. was useful for controlling weeds in potatoes after the haulms had died down. PCP at 5 lb./ac. destroyed potato haulms effectively and economically.—A.M.H.

1855 **Tasmania.** Department of Agriculture. Annual Report for 1956–57. Hobart, 1957, pp. 75. [Received June, 1958]
1. Wheat variety trials, p. 31. Macquarie was the highest-yielding commercial variety. In tests of hybrids, Hofed × Braemar 52·138 and Celebration × Macquarie 52·76 gave increases of 9 and 6 bu./ac., respectively, over the yield of the control variety Major.
2. Potato variety trials, p. 35. Bismarck again gave the highest yields in early-variety trials dug in January and April. Sequoia outyielded other mid-season and late varieties at low and high fertilizer rates [rates not stated]. Yields were 12·5 and 13·6 tons/ac. at low and high fertilizer rates, respectively.
3. Potato fertilizer requirements, p. 35. On calcareous sand at Woolnorth, 12 cwt./ac. of a 1: 2: 1 $(NH_4)_2SO_4$/superphosphate/ KCl mixture was superior to 6 cwt./ac. On grey sands at South Arm there were small responses to $(NH_4)_2SO_4$, but none to superphosphate. Further trials at Elliott Res. Fm showed that seasonal and soil variations were too great for accurate prediction of fertilizer needs, even for the one farm.
4. Seed-potato treatment, p. 36. Large setts (1·5 oz.) reduced pre-emergence losses and subsequent losses from blackleg (*Erwinia carotovora*). Whole seed was superior to cut seed, but losses were reduced when cut seed was dipped in streptomycin solution (streptomycin sulphate, 50 and 200 ppm. for 1 min., p. 44). Captan had no effect on emergence, but thiram decreased it.
5. Soil-preparation for potatoes, p. 36. Treatments compared were (a) surface cultivation only, (b) ploughing and working down before planting, (c) chisel-ploughing before planting, to break any hard pan and (d) chisel-ploughing and ploughing before planting. There were no differential effects on emergence, but chisel-ploughing decreased yields. [No figures given.]
6. Factors affecting tuber-formation in potatoes, p. 36. High night temperatures (approx. 60°F. min.) increased the weight of leaves and stems but reduced the weight of tubers.
7. Control of potato-blight (*Phytophthora infestans*), p. 44. Zineb (2·5 lb./ac., low volume) and Bordeaux mixture (4–2–40, high volume) were applied at fortnightly intervals or after periods of favourable weather according to the Irish rules (ignoring the first, or the first 2 favourable periods). Unsprayed control plots yielded 4·1 tons/ac. ; plots sprayed regularly, 9·4 tons/ac. ; those sprayed when the first warning was ignored, 7·5 tons/ac. ; and those sprayed when the first 2 warnings were ignored, 5·4 tons/ac.
8. Weed control, p. 38. Blackberry [*Rubus* spp.] can be controlled by spraying with 2,4,5-T (2 fl. oz. 40% 2,4,5,-T/gal. diesel distillate or 40 parts diesel distillate and 60 parts sump oil) in June, July or August [winter], in localities where summer spraying might cause drift damage. CMU kept soil bare or most weeds for 2 yr. Its effect was of shorter duration in areas with more than 30 in. annual rainfall ; the application of 50 lb./ac. is

recommended for vegetation not more than 2 in. high. Boron trioxide, used in 2 applications of 1200 lb./ac. 3 months apart, persisted for about 12 months only. Serrated tussock [*Nassella trichotoma*] was controlled by spring spraying with 20 lb./ac. of dalapon. 2,4-D ester (2 lb. a.e./ac. applied at the early flowering stage) killed off top growth and prevented seeding of Cape tulip [*Homeria* sp.], but was not thought to have eradicated the plants completely.

9. Diseases of tick beans [*Vicia faba* var. *minor*], p. 43–4. In laboratory experiments, *Botrytis* could be eliminated from bean seed by treatment at 117°F. for 20 min. following 18 hr. in tap water. In field trials no *Ascochyta* or *Botrytis* was detected in crops grown from seed which had received various heat treatments (15 min. at 142°F. without presoaking ; 20 min. at 118·5°F. after 16-hr. soaking; or 20 min. at 120°F. after 20-min. soaking).—A.M.H.

BOOKS

1856 SĂVULESCU, T. [Ed.] Porumbul. Studiu monografic. **[Maize. A monograph.]** 1957, pp. 926, bibl. at end of chaps ; subject-, plant- and author-indexes, illus., 30 × 21 cm., Bucharest : Acad. Republ. Popul. Romania.

1857† DEMBIŃSKI, F. and others. Prace nad roślinami oleistymi w latach 1951–1955. Zeszyt 2. **[Work on oil plants during 1951-5. Pt 2.]** *Publ. 61 Inst. Soil Sci. and Cult. Plants, Poland* 1957, pp. 184, Warsaw : State Publ. House for Agric., English and Russian summaries.

The following papers are included : Winter rape as green fodder and for seed, by K. J. Witkowski ; Seeding winter rape in a cover crop, by M. Priebe ; Spring and earlier sowing of winter rape, by F. Dembiński ; Simultaneous sowing of winter rape and winter cereals, by F. Dembiński ; Autumn sowing of red clover with winter rape, by W. Misterski ; Comparison of 4 varieties of winter rape in regard to bursting and non-bursting of siliquas in various ecological and geographical conditions, depending upon time of harvesting, by K. J. Witkowski and A. Hoffmannowa ; The time and depth of seedbed ploughing for winter rape, by F. Dembiński ; The problem of summer rape sowing time, by K. J. Witkowski ; The influence of row spacing and seeding amounts on yields of summer rape as depending upon high and low applications of fertilizers, by A. Hoffmannowa ; Additional fertilization of summer rape with nitrogen, by A. Horodyski ; Collection of oil-yielding-flax (linseed) varieties at the Flax and Hemp Central Experimental Station in Poznań in the years 1947–1950, by J. Kryński; The influence of spacing of plants on yields of seed and oil content in the sunflower as depending upon high and low application of fertilizer, Przybroda 1951–1953, by A. Horodyski and others ; The influence of sowing time and seed density on yields of seeds and oil in *Perilla*, by M. Jabłoński.—M.H.

1858† PÄTZOLD, C. Die Topinambur als landwirtschaftliche Kulturpflanze. **[Jerusalem artichoke as an agricultural crop.]** 1957, pp. 170, bibl. 1304, illus., 29 × 21 cm., Bonn/Bad Godesberg : Min. Food., Agric., For. ; and AID. [Inst. Pflanzenbau und Saatguterzeugung, Forschungsanstalt für Landwirtschaft, Braunschweig-Völkenrode, W. Germany]

This monograph on *Helianthus tuberosus* combines an extensive literature survey with results of experiments conducted at Völkenrode from 1949 to '56. The first part is largely a literature review. It begins with documented lists of scientific synonyms for *Helianthus tuberosus* and of common names in 19 languages ; there are also brief notes on the history of its cultivation in all parts of the world since the 17th century. The botany of the crop is adequately dealt with. The second part is concerned with the cultivation and utilization of *H. tuberosus* ; here the results of the experiments referred to above are gathered together. They include the influence of cultivation measures, such as depth of planting, spacing, water supply and time of harvesting on the yield of tops and tubers. Its high resistance to frost damage and hence the continued viability of any tubers left in the ground has, in the past, caused *H. tuberosus* to be regarded as a problem crop ; but present-day herbicides make it possible to grow *H. tuberosus* in rotation with cereals, instead of continuously on the same land. [See *Fld Crop Abstr.* 8 : 875, 1443, 1444.] Under utilization, 3 methods are discussed : tops alone, tubers alone, and combined use of tops and tubers. This last method requires a cutting system so timed that it provides young green fodder for animals while leaving sufficient green growth to provide for tuber development in the autumn. A June cut provides valuable fodder and is followed by renewed growth of tops which, in time, feed the tubers. The tops yield green fodder comparable in quantity and quality with other green fodders, and, if there is a sufficient water supply in late summer and autumn, the tuber yield is comparable with that of potatoes or fodder-beet. There is no subject index to this work but the bibliography is followed by a subject classification of the literature references.—D. BROWN.

1859† KOTOV, M. I. and BARBARIČ, A. I. [Eds] **[Flora of the Ukraine, Vol. 8.]** [Ukrainian]

1957, pp. 543, illus., Kiev: Acad. Sci. Uk.R.S.R., 17 × 25 cm., 33 roubles.

See also *Fld Crop Abstr.* 9 : 308.

1860 Randhawa, M. S. **Agricultural research in India. Institutes and organizations.** 1958, pp. v + 448, illus., 32 maps, 28 × 23 cm., New Delhi : Indian Council of Agricultural Research, 40s. [Received June, 1958]

This book provides a comprehensive survey of the organization and activities of agricultural research institutions in India. The organization, finance and method of operation of the Indian Council of Agricultural Research is described and the research schemes financed by the Council are listed. The history and organization of the central research institutes and the work of their departments are described. The distribution is mapped of stations for research on wheat, maize, millet, cotton, oilseeds, rice, potatoes and jute. The work of the Central Commodity Committees dealing with cotton, jute and oilseeds is described and the schemes financed by each are listed. An account of the work of various institutions controlled by the Committees is also given. The distribution of the 483 agricultural research stations is tabulated by States and the stations are classified according to the crops dealt with. For each station and experimental farm the address, date of establishment, nature of work and managing authority are listed. In most cases the annual rainfall, latitude, longitude, altitude and soil type are also given. The distribution of stations in each state is mapped. Appendices give details of expenditure on agricultural research and of the technical personnel of the Central Research Institutes and Commodity Committees.—A.M.H.

1861 Council of Scientific and Industrial Research, New Delhi. **The wealth of India. A dictionary of Indian raw materials and industrial products. Raw materials. Vol. 4 : F-G (with index).** 1956, pp. 323, bibl., illus., 28 × 21 cm., New Delhi : Council of Scientific and Industrial Research, 52s. [Received July, 1958]

The present volume contains about 340 entries of animal, mineral and plant products of India. By far the largest number of entries is on plant species (325) arranged alphabetically by scientific name. The largest single article in this volume is devoted to cotton (pp. 170–251). *Glycine* spp., *Fagopyrum esculentum*, and *Guizotia abyssinica* are other field crops described. This volume follows the pattern of previous ones. It gives a list of books and periodicals referred to in the text and a comprehensive index of common names in English and Indian languages. The volume is well illustrated. —D.B.

1862† Mali, L. Maatalouden sanakirja. [**Agricultural dictionary. In Finnish, Swedish, German and English.**] 1958, pp. xxviii + 177, 25 × 18 cm., Helsinki : Kustannusosakeyhtiö Otava.

Much praise is due to the author for having undertaken and brought to such a successful conclusion the arduous task of compiling this dictionary. It constitutes an authoritative, multilingual dictionary of the terminology in the whole field of the science and practice of agriculture in Finnish, Swedish, German and English. The main section of 593 pages consists of the Finnish terminology and definitions, with the Swedish, German, English, and, where necessary, the American, equivalents of each entry. Three shorter sections embody the Swedish, German and English terminologies, each item of which is given a page and line reference to enable its equivalent in the Finnish section, and thus the other two languages, to be found. Except in the case of Finnish, no claim is made that all local and regional variations of particular words have been given ; also, the terminologies of fields in which rapid technical progress is being made are extremely difficult to define to the satisfaction of all. Considerable pains have been taken to arrive at terms widely regarded as conforming to accepted standards and, with these qualifications in mind, it can fairly be claimed that the coverage is remarkably complete.

There has never been a greater degree of interest on the part of agriculturists in the work published by their colleagues in other lands than now but, so often, language constitutes a grave hindrance to understanding. This dictionary is to be welcomed as a very material aid, both to those engaged in the task of translation from other languages and to those concerned with producing summaries and translations in languages other than their own.—P. J. Boyle.

1863† Deighton, F. C. **Vernacular botanical vocabulary for Sierra Leone.** 1957, pp. 176, 16× 25 cm., London : Crown Agents for Overseas Governments and Administrations, 13s. 6d. [Received June, 1958]

The plants for which vernacular names have been collected are indexed under their botanical names. There follow vocabularies, mainly of plant names, in 14 vernaculars.—A.M.H.

1864† Wood, R. C. **A note-book of tropical agriculture.** Revised edn 1957, pp. 256, illus., 17 × 11 cm., Trinidad : Imp. Coll. Trop. Agric., 12s. 6d.

1865† Harrison Church, R. J. **West Africa. A study of the environment and of man's use of it.** 1957, pp. 547, bibl. in each chapter, illus., maps, 22 × 14 cm., London, New York, Toronto : Longmans, Green & Co., 45s.

Part I deals with the physical conditions in

West Africa and with some of the human problems which they present. Part II analyses the agriculture and mineral resources and includes chapters on transport and on population distributions. Part III is an examination of each individual country. The regional approach has been adopted throughout most of the book.—C.L.S.

1866† Crafts, A. S. and others [Eds]. **Annual review of plant physiology. Vol. 9.** 1958, pp. 510, 23 × 14 cm., Palo Alto, California : Annual Reviews Inc., $7·50.

The following papers are noted : (1) Physiology of salt tolerance. By L. Bernstein and H. E. Hayward, pp. 25–46. (2) The naturally-occurring auxins and inhibitors. By Joyce A. Bentley, pp. 47–80. (3) Destruction of auxin. By P. M. Ray, pp. 81–118. (4) Metabolism of ascorbic acid in plants : Part 1. Function. By L. W. Mapson, pp. 119–50. (5) The metabolism of amino acids and proteins in plants. By E. W. Yemm and B. F. Folkes, pp. 245–80. (6) Herbicides. By E. K. Woodford and others, pp. 310–58.

1867 Steinhaus, E. A. and Smith, R. F. [Eds]. **Annual review of entomology. Vol. 3.** 1958, pp. 520, 23 × 13 cm., Palo Verde, California : Annual Reviews, Inc., $7·50.

The following papers are noted : Resistance of plants to insects. By R. H. Painter, pp. 267–90; Organic phosphorus insecticides for control of field crop insects. By W. A. L. David, pp. 377–400. —P.J.B.

1868† United States Department of Agriculture. **Soil. The yearbook of agriculture 1957.** [n.d.], pp. 784, illus., 24 × 15 cm., Washington : U.S. Govt Printing Office, $2·25.

This yearbook is a successor to that published in 1938, entitled " Soils and men", which is now out of print, and which laid emphasis on such aspects as soil classification, the technical aspects of soil science, and land-use, as opposed to soil-use. The present book is directed more toward the subject of soil management in its different aspects. There are sections on the basic principles of soil science, soil fertility, management practices, the care and conservation of soil, soil moisture, cropping systems and soil surveys, soil management practices suitable for different parts of the USA and for specialized crops. There is a glossary of terms and an index.—P.J.B.

1869† Nicholson, E. M. **Britain's Nature Reserves.** 1957, pp. 175, bibl. 37, illus., 1 map, 22 × 15 cm., London : Country Life Ltd., 30s. [Received July, 1958]

1870 McElroy, W. D. and Glass, B. [Eds]. **A symposium on inorganic nitrogen metabolism : function of metallo-flavoproteins.** 1956, pp. 741, illus., 23 × 15 cm., Baltimore : The John Hopkins Press, 80s. [Received July, 1958]

1871 Agricultural Economics Research Institute. **The Agricultural Register (New Series). Changes in the economic pattern 1956-7.** 1957, pp. 234, 22 × 15 cm., Oxford : Agric. Econ. Res. Inst., 21s. [Received July, 1958]

This book attempts to give a concise and impartial account of the present position regarding action taken on matters of policy, finance, marketing, etc., by U.K. government departments, marketing boards and similar bodies. There are three chapters on the marketing and prices of U.K. produce. A section on cereals deals with standard prices and deficiency payments and their effect on disposal of supplies ; the pattern of cereal imports and utilization ; and the International Wheat Agreement and the attitude of the British Government to it. The other crops considered are potatoes and sugar-beet. The development of the European Free Trade Area and the British attitude, as far as agriculture is concerned, is discussed. In a chapter entitled Imports, topics dealt with include : imports of foodstuffs, feeding-stuffs and fertilizers ; anti-dumping measures ; and General Agreement on Tariffs and Trade negotiations. Trends in agricultural employment and wages and the operation of the system of production grants are discussed. The final chapter, Inputs, reviews trends in farm expenditure on labour, fertilizers, feeding-stuffs and machinery.—A.M.H.

NEWS ITEMS AND NOTES

Great Britain

1872 Sugar-beet Seed Production. In an effort to save a year, a farmer in Lincolnshire has sown his sugar-beet for seed under a crop of wheat. The wheat was drilled at 1 cwt./ac. in early March in 15-in. rows and the beet cross-drilled at 5 lb./ac. in early May in 20-in. rows. At harvest a long stubble will be left and the beet allowed to grow into the seed crop. *Fmr's Wkly, Lond.*, 25th July 1958.—C.L.S.

Canada

1873 Commonwealth Institute of Biological Control. Dr. F. J. Simmonds has been appointed Director of this Institute, and will succeed Dr. W. R. Thompson, who retires shortly.

Kenya

1874 Soil Conservation. A soil conservation scheme for hilly land is described, in which small dams or bunkers, made with normal farm implements, are used instead of contour terraces. It is claimed that this system greatly reduces capital and running costs, decreases the weed-control problem and helps to conserve water. It is suitable for slopes of up to 10%. *E. Afr. Fmr and Planter*, June, 1958. —A.M.H.

International

1875† Forthcoming International Scientific and Technical Conferences are given in List No. 23 published in July 1958 by the DSIR Overseas Liaison Division, Africa House, Kingsway, London. The following 1958 Conferences will be of interest to agriculturists :

4–13 Oct.	International Federation of Agricultural Producers Congress at Brussels, Belgium.
20–23 Nov.	European Confederation of Agriculture Meeting at Vienna, Austria.—C.L.S.

New Publications

1876 In December 1957, the Colonial Products Laboratory left the Imperial Institute Building and moved into new premises at 56/62 Gray's Inn Road, London, W.C.1. At the same time the name of the Laboratory was changed to the Tropical Products Institute.

It has now been decided to change the title of the journal *Colonial Plant and Animal Products* ; in future it will appear under the title *Tropical Science* and Volume 1 will be published soon.—C.L.S.

Enquiries received

1877 Arising from enquiries received and answered by the Bureau from March to July 1958, bibliographies on the following were prepared and are available, on request, from the Director : Swede-turnips ; Noxious nitrogen in sugar-beet.—C.L.S.

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Books
Adam, J. and Ferrand, M. [Oil crops in French tropical Africa (Negro Africa —Madagascar). Vol. 1. Pt 1. Cultivation], 1337
Agric. Econ. Res. Inst., Oxford. The Agricultural Register (New Series). Changes in the economic pattern 1956–7, 1871
All-Union Sci. Res. Inst. Cott. Prod., Taškent. Works of the Ak-Kavak Central Agro-technical Station, 436
Bareš, M. [The cultivation of farm crops], 1344
Bates, W. N. Mechanization of tropical crops, 1345
Bergbau Handel. Magnesium– a plant food. Essays on the problem of magnesium fertilization, 440
Brown, H. B. and Ware, J. O. Cotton, 1335
Cardozier, V. R. Growing cotton, 871
Comar, C. L. [Ed.] Atomic energy and agriculture. A symposium presented on December 27–29, 1955. . . . [Atlanta, USA], 880
Commonw. Bur. Soils. Bibliography of soil science, fertilizers and general agronomy, 1953–6, 445*
Crafts, A. S. and others. [Eds] Annual review of plant physiology, 1866
CSIR, New Delhi. The wealth of India. A dictionary of Indian raw materials and industrial products. Raw materials Vol. 4 : F–G (with index), 1861
Deighton, F. C. Vernacular botanical vocabulary for Sierra Leone, 1863
Dick, W. E. Atomic energy in agriculture, 879
Drummond, J. C. and Wilbraham, A. The Englishman's food. Five centuries of English diet, 881
Gillespie, J. and Hathaway, P. A textbook of general agriculture 1341
Halperin, H. Changing patterns in Israel agriculture, 875
Harrison Church, R. J. West Africa. A study of the environment and of man's use of it, 1865
Hudson, J.P. [Ed.] Control of the plant environment. Proceedings of the University of Nottingham 4th Easter School in Agricultural Science, 1957, 876
Hughes, E. D. and Henson, E. R. Crop production. 2nd edn, 438
Humphrey, N. A review of agriculture and forestry in the island of St. Helena, 1340
Iso, E. Rice and crops in its rotation in subtropical zones, 437
Klapp, E. [A text-book of soil- and crop-cultivation], 1342
Klingman, G. C. Crop production in the South, 1343
Kotov, M. I. and Barbarič, A. I. [Eds] [Flora of the Ukraine, Vol. 8], 1859*
Lee, D. H. K. Climate and economic development in the tropics, 1349
Ludlam, F. H. and Scorer, R. S. Cloud study. A pictorial guide, 443
McConnell, P. The agricultural notebook, 1352
McElroy, W. D. and Glass, B. [Eds] A symposium on inorganic nitrogen metabolism : function of metallo-flavoproteins, 1870*
MacFarland, C. S. [Ed.] American potato yearbook, 1333
McKay, R. Cereal diseases in Ireland, 874
Mali, L. [Agricultural dictionary], 1862
Martin, H. Guide to the chemicals used in crop protection, 1827
Matsuo, T. Rice culture in Japan, 870
Miller, A. A. Climatology, 1348
Montenez, J. [Experimental investigations into the ecology of germination in groundnuts], 1336
Nicholson, E. M. Britain's nature reserves, 1869*
Norman, A. G. [Ed.] Advances in agronomy. Vol. 9, 1346*
Pätzold, C. [Jerusalem artichoke as an agricultural crop], 1858
Piacco, R. [Handbook on rice-growing], 1334
Plant Protection Ltd. Proceedings 2nd International Conference, Fernhurst, 1957, 444
Randhawa, M.S. Agricultural research in India. Institutes and organizations, 1860
Reifenberg, A. The struggle between the desert and the sown. Rise and fall of agriculture in the Levant, 442
Richharia, R. H. Plant breeding and genetics in India. Vol. 1, 1351*
Săvulescu, T. [Ed.] [Maize. A monograph], 1856*
Schindlmayr, A. Useful plants, 873
Sethi, B. L. and Dharmarajulu, K. Indian cotton — its past, present and future, 872*
Smith, L. P. Farming weather, 1350
Steinhaus, E. A. and Smith, R. F. [Eds] Annual review of entomology. Vol. 3, 1867
Stehlík, V. and others. [Sugar-beet-growing], 1332*
Terrien, J. Light, vegetation and chlorophyll, 877
Timoshenko, V. P. and Swerling, B. C. The world's sugar. Progress and policy, 1339
UNESCO. Arid zone research. 5. Plant ecology. Proceedings of the Montpellier symposium, 441
United Nations. Proceedings of the International Conference on the Peaceful Uses of Atomic Energy, held in Geneva, 8–20 August, 1955. Vol. 12. Radioactive isotopes and ionizing radiations in agriculture, physiology, and biochemistry, 435
U.S. Dep. Agric. Soil. The yearbook of agriculture 1957, 1868
Went, F. W. The experimental control of plant growth. With special reference to the Earhart Plant Research Laboratory at the California Institute of Technology, 439
Wood, R. C. A note-book of tropical agriculture, 1864*
Žukovskiĭ, P. M. [Ed.] [Wheat in the USSR], 1331
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Tasmania
Dep. Agric., 1955–6, 1854
Dep. Agric., 1956–7, 1855
Western. Kimberley Res. Sta., 1950–8, 1853
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Cyprus. Dep. Agric., 1956, 1327
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Soc. Encourage. Cult. Orges Brass. Houbl. Fr., 1955, 1438
Ghana
Dep. Agric., 1954–5, 864
Dep. Soil Land-Use Surv., 1955, 769
Great Britain
Cttee Col. Agric., Anim. Hlth, For. Res., 1955–6, 429
Cttee Privy Counc. Agric. Res., A.R.C., 1956–7, 1846*
Edinb. E. Scot. Coll. Agric., 1957, 1324
Emp. Cott. Gr. Corp.
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Grassl. Res. Inst., Hurley, 1956–7, 1790
Jersey, States of. Cttee Agric. States Exp. Sta., Howard Davis Fm, 1956, 702
Nat. Veg. Res. Sta., Wellesbourne, 1957, 1845
Norfolk Agric. Sta., 1957, 482
Rothamsted Exp. Sta., 1957, 1544, 1616, 1660, 1756, 1795, 1843
W. Scot. Agric. Coll., 1957, 1844
Guatemala. Minist. Agric., Serv. Coop. Interamer. Agric., 1955, 433
Hong Kong
Dir. Agric., Fish., For., 1955–6, 866
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India
Cent. Rice Res. Inst., Cuttack, 1954–5, 584
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Northern. Minist. Agric. Res. Exp. Rec., 1956, 859
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Jamaica. Dep. Agric., 1955, 1049
Jordan. Minist. Agric., Agric. Res. Serv., 1956, 863
Kenya. Dep. Agric., 1955, 432
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Mauritius. Dep. Agric., 1955, 865
Netherlands
Cent. Inst. Landbouwk. Onderz., Wageningen, 1956, 861
Comm. Bevord. Suikerbiet. Noord. Prov., 1956, 223
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Ned. Graan-Centrum, Wageningen, 1956, 1070
New Zealand. Dep. Statist., yrbk 1957, 867
Nigeria.
Dep. Agric. Res., 1956–7, 1848
W. Afr. Rice Res. Sta., 1956, 1053
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Sicily. Staz. Sper. Granicolt., 1953–5, 431
Sierra Leone. Dep. Agric., 1956, 1051
Surinam. Dep. Agric., Anim. Husb., Fish., 1954, 434
Switzerland. Eidg. Landw. Versuchsanst., Zürich-Oerlikon, 1956, 862
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